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The Touchscreen Advantage: Understanding the Educational Value of Touchscreen Applications for Preschool-Age Children

Maggie Andersen
Brigham Young University

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Abstract:

This literature review seeks to determine whether educational applications (apps) available on touchscreen devices have a positive impact on preschool children's learning. Past research has focused on the effects of devices such as computers or TVs. However, by comparing that research with new research on touchscreen devices, the potential benefits of educational apps can appear. Educational apps may be beneficial to young children by providing improved forms of interactivity.

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Recently, screen-based media have become an integral part of society. As cell phones, computers, and tablets have become more accessible to the general public, young children's accessibility to this technology also has increased. Some educational applications (apps) are designed specifically for preschool-age children. Unlike television- or video-watching, these touchscreen apps operate interactively to teach children colors, shapes, sign language and more. Although screen time can have negative effects on young children, as long as apps are not used for excessive amounts of time and a parent continues to interact with the child during app use, educational apps may have positive effects on child development.

Young Children and Apps

As touchscreen cellphones and tablets have become increasingly popular, young children have greater access to them. If touchscreens are sufficiently easy for young children to interact with, these devices may aid children's learning more than other technology does.

Touchscreen Benefits

Young children are able to use touchscreen devices with ease since they require little precise hand-eye coordination. Also, young children have a harder time using a computer

mouse because it requires them to understand that the mouse corresponds to the cursor on the screen (Menkes, 2013).

Because touchscreen devices are easier for children to use than computers are, young children may learn more from an educational app than an educational computer program that lacks touchscreen interactivity (Geist, 2012).

In addition, touchscreens provide a way for young children to use apps without having to be readers or writers (Plowman & McPake, 2012). Additionally, Geist (2012) found that young children are able to access the apps they want and interact with them by themselves. It is also the case that touchscreen devices may provide a level of interaction that educational TV does not. One study found that young children ages 30 and 36 months transferred their learning to a real-life scenario using interactive computer demonstrations with the same success as they did with real-life demonstrations (Lauricella, Pempek, Barr, & Calvert, 2010). Interactive-video demonstrations were less effective.

Length of Time

Numerous studies have shown adverse effects of increased screen viewing on young children, where screen time included TVs, DVDs, video games, and computers (see,

e.g., Sweetser, Johnson, Ozdowska, & Wyeth, 2012). One longitudinal study examined the effects of increased screen time on children at ages 29 months, 53 months, and in the fourth grade (Pagani, Fitzpatrick, Barnett, & Dubow, 2010). The authors found that every additional hour of TV exposure at 29 months was associated with greater risk of subsequently displaying attention deficits and lower achievement in mathematics. Similarly, when children under the age of three watched two or more hours of TV daily, they tended to score lower in later tests of cognitive development and academic achievement (Duch et al., 2013a). Accordingly, the American Academy of Pediatrics (AAP) has recommended that children two and under should avoid screen time, and that children between two and five years old engage in no more than one or two hours of screen time per day (Carson & Janssen, 2012).

Even though the AAP has published guidelines for screen-media use in general; research has shown that children tend to far exceed these guidelines. For example, Zimmermann, Christakis, and Meltzoff (2007) found that, by two years of age, 90% of children had already begun watching TV. Additionally, Duch, Fisher, Ensari, Font, Harrington, Taromino, Yip, and Rodriguez (2013a) found that, in their

sample of 119 infants and toddlers, children watched an average of 3.29 hours of TV per day. Courage and Howe (2010) reported that, even though educational-interactive screen time does not produce the same negative effects as more passive forms of media do, apps should still be used conservatively, given that research has yet to indicate how much exposure causes the potential costs to outweigh the potential benefits. Falloon (2014) observed a kindergarten class's use of touchscreen devices and found that, when certain apps were repeatedly used, students became bored and no longer used the app effectively. Similarly, Hancox, Milne, and Poulton (2005) argued that preschool children's increased TV screen time could be detrimental to their development.

Effects of Different Types of Screen Time

Although research primarily has focused on the negative impacts of screen time on children's cognitive development and physical health, different types of screen time affect children differently.

Active versus Passive Screen Time

Passive screen time refers to viewing that is sedentary or that otherwise involves little interaction by the viewer, such as watching TV (Sweetser et al., 2012). Researchers have found

a positive relation between screen time and subsequent risk of attention problems (Pagani et al., 2010). Additionally, young children whose screen time was passive had more difficulty translating what they learned to a real-life setting than did children whose screen time was active (Lauricella et al., 2010). Educational apps can be considered active when they offer interactivity and are cognitively involving (Sweetser et al., 2012). Bittman, Rutherford, Brown, and Unsworth (2011) found that among children ages four- to eight-years-old, both reading and using a computer for purposes other than gaming positively affected children's literacy scores; however, using electronic games did not have this effect. Another study found that, for boys, as time spent playing video or computer games increased, their aggressive behaviors tended to increase, and their school performance decreased (Hastings, Karas, Winsler, Way, Madigan, & Tyler, 2009). On the other hand, the use of explicitly educational games not only correlated with a lower incidence of attention deficits but also lower aggression. Therefore, effective educational apps must intend to support children's learning and development in cognitively engaging ways to avoid the negative effects of electronic games and passive media (Chau, 2015).

Media Designed for Children versus Adults

Zimmermann and Christakis (2007) found that, when children three and younger watched violent or nonviolent for adult media, each hour per day of average viewing was associated with double the odds for attention deficits five years later. However, the same authors also found that, when young children watched educational TV shows, there was no significant relation between time viewed and subsequent attention problems.

Supported Learning

For educational apps to have educational value for preschool children, research suggests that certain forms of support must be in place, including adult monitoring and involvement during app use. An app's design ideally provides appropriate cognitive "scaffolding" for its users.

Adult Interaction

An adult should participate in joint media engagement with their child during app use in order for it to benefit young children. Joint media engagement refers to parents and children co-viewing or co-playing during media use (as cited in Chau, 2015). Although researchers have not specifically studied parent involvement in children's app usage, researchers

have examined parent involvement in other forms of screen time. According to Mendelsohn et al. (2011), parental absence predicts children's excessive screen time. Bittman et al. (2011) asserted that the absence of interaction guided by an adult may be more harmful to children's language acquisition than overexposure to screen media. In order for educational apps to have a positive impact, preschool children need to understand how to use them. When children have questions about or need help deciphering print that appears on the touchscreen, adults can answer the questions (Neumann & Neumann, 2014). Parents also teach young children how to use touchscreen devices and apps by example. Plowman and McPake (2014) reported that young children imitated adults' interactions with touchscreen devices. For Geist (2012), such imitation means that children learn how to use the devices fairly quickly with minimal adult direction.

Yelland and Masters (2007) described cognitive scaffolding that supports preschool children's learning. Asking questions and providing positive feedback, including encouragement, was especially beneficial. Additionally, Smeets and Bus (2012) found that, when children read from an e-book that asked them comprehension questions about the material,

they were quicker to acquire previously unknown words (Smeets & Bus, 2012).

App Design

Apps for preschool children need what Yelland and Masters (2007) referred to as technical scaffolding. For example, Falloon (2014) found that, when children used apps that had confusing instructions or goals, they often gave up and switched to other, simpler apps. When the app provided feedback to children's responses, for example, when learning new words, Smeets and Bus (2012) reported that children did better at learning the words being taught.

Apps that are advertised as educational may not incorporate scaffolding that benefits young children. Plowman and McPake (2014) found that, even though touchscreen devices may promote interaction, it is not sufficient to guarantee a high-quality learning experience. In fact, Falloon (2014) found that many of the educational apps allegedly designed for young children lack important learning features, such as corrective feedback.

Conclusion

My review of the literature supports the claim that educational apps used on touchscreen devices may avoid

at least some of the negative effects on preschool children's cognitive development that characterize other media. Because touchscreen devices typically are easy for young children to use, well-designed apps that include appropriate cognitive scaffolding may facilitate learning when used with proper adult support. Indeed, young children may be able to learn better with these kinds of devices than with other technology, such as computers or TV. Information about the measurable effects of educational apps on preschool children's cognitive development may be beneficial to parents in deciding whether or not to provide their children with access to apps and how best to interact with the child during their use.

There are several unanswered questions that future research should address. Specifically, longitudinal researchers should examine the comparative effects of apps and other forms of educational technology and develop recommendations to parents and teachers about the most effective use of touchscreen devices in their children's education.

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