Critical Review

Does touch-screen tablet use impact preschoolers' emergent literacy skills?*

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This critical review examines the evidence regarding the impact of touch-screen tablet use on the emergent literacy skills of typically developing preschool children. A search of the literature yielded three papers with study designs that included descriptive and non-randomized clinical trials. Research results suggested that touch-screen tablet use facilitates the development of emergent literacy skills in preschool children. Clinical implications and recommendations for future research are provided.

Introduction

Our society is becoming increasingly digital thanks in large part to companies like Apple and Samsung. These innovative companies continually develop new technologies, hoping to create the new best device that consumers "have" to buy. Unlike in the past when technology was geared towards adults in the business sphere, today technology is not only kid friendly but developed *for* kids. In 2013, it was estimated that 40% of children had access to touch-screen tablet devices, such as the iPad, at home (Rideout, 2013). This figure is likely even higher today based on the staggering increase from 2011 (8%) to 2013 (40%) (Rideout, 2013). Furthermore, electronic devices are increasingly being implemented in schools as a learning tool (Couse & Chen, 2010). This staggering increase in access to touch-screen tablets reveals an important question: how are such devices impacting the individuals who use them – including young children?

One important area of development for preschool children is emergent literacy. Emergent literacy skills include phonological awareness, print concepts, alphabet knowledge and literate language (Paul & Norbury, 2014). These skills are important precursors to later literacy skills, such as reading and writing, which are essential for success in school (Neumann & Neumann, 2014; Paul & Norbury, 2014).

Research that has shown that children learn to use many features of a touch-screen tablet very quickly when supported by adults and peers (Couse & Chen, 2010). In addition, various features of touch-screen tablets have been hypothesized to promote the development of emergent literacy in young children. These include the book-like shape, ability to rotate the interface for correct orientation of stimuli, as well as the interactive and multimedia interface (i.e., visual, tactile, auditory) that offers instant feedback to the user (Neumann & Neumann, 2014). However, the notion that these features may promote emergent literacy skills is solely theoretical and speculative. Together, children's ability to learn how to use tablets along with certain tablet features build a strong rationale for understanding whether tablet use impacts preschoolers' emergent literacy. Research is needed to reveal the true impact of touch-screen tablet use on preschoolers' emergent literacy. For speech-language pathologists, understanding the potential impact of touch-screen tablets on preschoolers' emergent literacy skills would help answer two questions. First, are touch-screen tablets appropriate to use in intervention targetting emergent literacy skills with preschoolers? And secondly, should speech-language pathologists recommend to families that their preschool children use touch-screen tablets?

This review will critically examine the evidence currently available pertaining to the impact of touch-screen tablet use on the emergent literacy skills of typically developing preschool children.

Objectives

The primary objective of this paper is to critically review the existing, albeit sparsely available, literature regarding whether touch-screen tablet use impacts the emergent literacy skills of preschool children. The secondary objective is to propose evidence-based clinical implications for using a tablet with such young children.

Methods

Search Strategy

Computerized databases including PsycINFO, Scopus and Google Scholar were searched using the following

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key terms: ((tablet) OR (e-book) OR (iPad)) AND (preschool*) AND ((emergent literacy) OR (phonological awareness) OR (concepts about print) OR (print concepts)).

Selection Criteria

The studies selected for inclusion in this critical review were required to include preschool children (within age range of 3-5 years), use of touch-screen tablets (regardless of the type of application), and at least one measure of emergent literacy (phonological awareness, concepts about print, alphabet knowledge or literate language). No limitations were placed on the research design.

Data Collection

Results of the literature search yielded three articles congruent with the aforementioned selection criteria with descriptive (1) and non-randomized clinical trial (2) research designs.

Results

Descriptive research designs are appropriate for this area of study when the objective is to look at associations between at least one dependent and one independent variable. In addition, this design allows the researcher to gain a lot of information about potential variables that may affect the outcome measure which is appropriate when studying such a contemporary research topic.

Using a descriptive research design, Neumann (2014) analyzed the associations between access and time spent on tablets at home with various emergent literacy measures in 109 preschool children (3-5 years; 57 boys, 52 girls). Established and age-appropriate protocols were used to measure letter knowledge, letter sound knowledge, name writing, print concepts, and word reading at one time. Appropriate partial correlations (controlling for age) revealed statistically significant positive correlations between two measures of emergent literacy (namely, letter sound knowledge and name writing) and children's access to tablets at home (defined by number of tablets available at home).

The strengths of this study include the large sample size with relatively equal gender distribution as well as thorough description of the participants, materials, and procedures such that the study could be easily replicated. However, the descriptive design and related correlational analyses of this study make it difficult to draw strong conclusions regarding the relationship between tablet use and emergent literacy. Conducting a multiple regression involving more of the data collected in the study (e.g., tablet access, tablet use, child's ease of tablet use, parent's view on tablet use, type of apps used, socioeconomic status) to predict the various emergent literacy measures may have offered more detailed information regarding this relationship. In addition, the correlations between tablet access and two emergent literacy measures, although statistically significant, were relatively small in magnitude ($r < 0.3$). It is also unknown the extent to which social desirability bias impacted the results of the study as many of the measures were collected via parent report (i.e., tablet access, tablet use).

Overall, the results of this study provided somewhat suggestive evidence that touch-screen tablet use can facilitate the development of emergent literacy skills. However, the evidence should be taken in the context of the area of study. Tablet use and its impact on child development is a very contemporary topic. This study provided a strong foundation for the potential impact of tablet use on preschoolers' emergent literacy, and introduced many variables that may influence this relationship which can be taken into account in future research.

Non-randomized clinical trial study designs are appropriate for this area of study. In research with children, it is common to ensure certain variables (e.g., gender, pre-intervention abilities such as letter naming) are equally distributed across groups. This ensures that these variables do not differ significantly between groups and thus are not biasing the results. In addition, this design aligns with the objective of the studies, which was to determine the change in emergent literacy skills between two or more groups.

Using a non-randomized clinical trial design, Masataka (2014) compared the character-naming skills in 30 four-year-old boys who received parent-facilitated book reading over five consecutive days in two groups: print storybook or digital storybook. An appropriate measure of emergent literacy was used, namely character (letter) naming. An appropriate analysis of variance (ANOVA) revealed a significant increase in the number of characters named from pre- to post-test in only the digital storybook group. This increase was maintained in a follow-up study of the digital storybook group four weeks after the post-test.

This study has many strengths including equalizing the two groups on character naming ability before providing the intervention, including a comparison group (print book), and conducting a follow-up. However, the results of this study should be interpreted with caution for a number of reasons. First, a number of variables that could have affected the results were either not reported on or not controlled for. These include participant

characteristics (socioeconomic status, existence of neurological/ psychological/developmental disabilities) and methodological protocols (randomization of groups, parent engagement in book reading). In addition, only one measure of emergent literacy was included. Emergent literacy is the summation of many skills and it is unclear whether an improvement in only one of these skills would strongly support the overall development of emergent literacy.

Overall, the results of this study provided somewhat suggestive evidence that the use of an e-book on a tablet facilitates the development of preschoolers' emergent literacy skills, and possibly even more so than a traditional print book. It should be noted that this study was conducted in Japan and thus used Japanese characters and participants whose first language was Japanese. It is unclear how generalizable these results are to the English language.

Using a non-randomized clinical trial design, Willoughby, Evans and Nowak (2015) compared 92 preschoolers' (3-4 years; 45 boys, 47 girls) emergent literacy skills who received adult-facilitated book reading in 16 sessions over eight weeks. Three groups received different interventions: ABC e-book, ABC print book and print storybook. Established and age-appropriate protocols were used to measure letter naming, letter sound identification, and phonological awareness (PA) pre- and post-test. An appropriate split-plot ANOVA revealed that scores for all three emergent literacy measures increased from pre- to post-test for all three groups, but that there were no significant differences between the three groups.

The statistical results of this study are strong and are backed by a strong research methodology. The researchers not only compared ABC e-books and print books but included print storybooks as a control group (previous research has shown that ABC books but not storybooks facilitate the development of emergent literacy skills). The participants were quasi-randomly assigned in order to ensure gender and letter name knowledge were evenly distributed across the three groups. In addition, including several measures of emergent literacy provides a comprehensive picture of emergent literacy development. One major drawback of this study is that the ABC e-books and print books were different books (not the same books adapted to e-format). Therefore, it remains unclear why children in the print and e-book groups performed similarly on measures of emergent literacy. Two possible explanations include: 1) children learn similarly from print and e-book formats or 2) there was an interaction between book format and the strength of specific books in facilitating emergent literacy skills.

Overall, the results of this study provided compelling evidence that the use of an e-book on a tablet can facilitate the development of emergent literacy skills. However, the impact of using a tablet e-book was not stronger than more traditional materials (print ABC or story books).

Discussion

The critical appraisal of the evidence included in this review suggests that touch-screen tablet use facilitates the development of emergent literacy skills in preschool children. However, it remains unclear whether touch-screen tablets facilitate emergent literacy skills more than other more traditional materials, such as print books. As alluded to previously, tablet use and its impact on development is a very contemporary topic. The research in this area has taken two directions. Researchers such as Masataka (2014) and Willoughby and colleagues (2015) have taken previous research on other e-books (e.g., LeapPad print books with e-features) and adapted the methodology to involve new tablet devices. Contrarily, researchers such as Neumann (2014) have conducted descriptive research to determine any and all possible factors that need to be considered in this new area of research. Together, these two research directions provide valuable information that will help structure the direction of future research.

The research studies included in this review differed in which applications (apps) they included in their study. There are three main types of tablet apps: creating, gaming, and e-books (Michael Cohen Group & U.S. Department of Education, 2011). Creating apps offer tools for drawing, painting, building, puzzles, and other such activities (Neumann, 2014). Gaming apps comprise entertaining, repetitive actions and challenges such as the popular game Angry Birds (Neumann, 2014). E-book apps are interactive multimedia books with or without a built-in narrator (Neumann, 2014). Maintaining a descriptive study design, Neumann (2014) did not restrict or manipulate the type of apps children used. The results of this study, although significant, were not clinically robust. On the other hand, Masataka (2014) and Willoughby and colleagues (2015) both restricted app use to e-books and found strong effects of tablet use on emergent literacy skills. This may reflect a unique impact of e-book apps over creating or gaming apps on the facilitation of emergent literacy skills. However, more research is needed directly comparing the different types of apps to confirm this hypothesis.

Although Masataka (2014) and Willoughby and colleagues (2015) both studied the use of e-book apps

on tablet devices, the studies found different results regarding the effect of print versus e-book formats. Specifically, Masataka (2014) found that the emergent literacy skills of the children who used e-books improved more than those who used print books whereas Willoughby and colleagues (2015) found print and e-books similarly increased the emergent literacy skills of the children who used them. Certain methodological differences may shed some light on their different findings including: intervention intensity, reading facilitator, reading group size, and book selection. Masataka (2014) provided a short duration of intensive intervention, specifically once daily sessions for five consecutive days. Willoughby and colleagues (2015) provided less intense intervention over a longer duration, specifically twice weekly sessions for eight weeks. Thus, intense exposure to e-books may provide stronger facilitation of emergent literacy skills. The studies also differed in the person who facilitated the book reading, either being the child's parent (Masataka, 2014) or a research assistant (Willoughby et al., 2015). Thus, parents may provide a unique benefit over unfamiliar adults to the dyadic interaction during e-book reading that enhances the facilitation of emergent literacy skills. The studies also differed in the group size of the reading interaction, either being one-on-one with their parent (Masataka, 2014) or in small groups of three to four children with the facilitator (Willougby et al., 2015). Thus, one-on-one reading may be the optimal interaction to facilitate the development of emergent literacy skills. Lastly, the studies varied in how they selected print and e-books. Masataka (2014) used only one book (print book adapted to an e-book) over all five sessions, thus children had repeated exposures to the same book. Whereas Willoughby and colleagues (2015) used eight different e-books (one e-book used for two consecutive sessions). It is possible that certain e-books are more suited to facilitate emergent literacy skills, and that repeated exposure to the same e-book may scaffold the child's learning more than exposure to material that is constantly changing.

Conclusion

This review of the existing, albeit sparsely available, literature provides suggestive evidence that the use of touch-screen tablets facilitates the development of emergent literacy skills in preschool children. From the current research available, e-book apps may provide more support for the development of preschoolers' emergent literacy skills than creating or gaming apps.

Recommendations

For future research, the following factors need to be addressed:

i) Non-randomized control trials that control for and manipulate multiple variables of tablet use, including: frequency of use, tablet features, and presence of a facilitator (and if so, who)
ii) Non-randomized control trials that compare the effect of print and e-books, while controlling for more variables [as discussed in (*i*)]
iii) Studies that use multiple measures of emergent literacy skills
iv) Studies that examine and compare the effect of the three main types of tablet apps on emergent literacy
v) Studies that examine the impact of touch-screen tablet use in different populations (e.g., ASD, intellectual delay, learning disability)

Clinical Implications

This critical review has examined the current literature concerning the impact of touch-screen tablet use on preschoolers' emergent literacy skills and has revealed that there is suggestive evidence that touch-screen tablet use facilitates the development of emergent literacy skills in preschool children. This brings us back to the two questions posed in the introduction that are paramount for speech-language pathologists.

Are touch-screen tablets appropriate to use in intervention with preschoolers for emergent literacy skills? Especially with the other supports that speech-language pathologists provide, touch-screen tablets would be appropriate to use in therapy with preschoolers when working on emergent literacy skills. Similarly to all therapy materials, it is important to take into account all of the child's qualities when deciding whether to use a tablet device (e.g., sensory processing difficulties, fine motor abilities).

Should speech-language pathologists recommend to families that their preschool children use touch-screen tablets? Yes – however, the relatively stronger research in this area studied e-book apps. Therefore, until more research is completed, it would be appropriate to recommend to families that if a preschool child is using a touch-screen tablet device that more opportunities should be provided for using e-book apps than creating or gaming apps. However, due to the mixed research on print versus e-books, parent should not feel it is necessary to obtain an e-book to facilitate the development of their child's emergent literacy skills. Regardless of the book format, parents should read *with* their child, when possible, as this has been shown to increase children's engagement in discussion of print books and attention to features of print books (Paul & Norbury, 2014).

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