Learning in the Digital Age: Putting Education Back in Educational Apps for Young Children

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Introduction

In its most recent guidance on screen time in childhood, the American Academy of Pediatrics suggested that interactive apps should not be lumped into the same category as television.[1] Most people agree that passive screen time is less than ideal for infants younger than age 2 because it replaces opportunities for social interaction and motor exploration. However, technological advances have created a hybrid of interactive screen time that forces a re-examination of the hardline "avoid screens in childhood" stance. The idea that a single device (e.g., the iPad) could provide not 10, not 100, not 1,000, but 170,000 educational apps into the homes of children is a revolutionary concept.[2] But inherent in the term "educational apps" comes the implication that someone has determined that these apps are indeed educationally beneficial. The fact is, however, that nobody regulates the use of "educational" to describe apps, not developers, users or an independent review committee. What makes an app educational? And for whom?

Subject

Given the ubiquitous nature of technology in children's lives, it is critical to determine the educational potential of apps for children of various ages. Existing knowledge about children's cognitive and social abilities can inform best practices for app development and use.

Problems

Currently, “educational” is a free-for-all label used by children’s app developers. Scientific principles may serve to identify characteristics that increase the likelihood that an app is, in fact, educational.

Research Context

Hirsh-Pasek, Zosh, and colleagues[3] reviewed the literature from the Science of Learning – an amalgamated field from neuroscience, education, psychology, cognitive science, and linguistics - and used converging evidence to propose four pillars of learning to evaluate the educational potential of apps for children over the age of 2 years.

Key Research Questions

What can the Science of Learning tell us about the characteristics of apps that might increase or decrease their educational potential?

Recent Research Results

Below, we highlight the findings generated by the Science of Learning to identify the characteristics of apps with true educational potential. Subsequently we stress that the learning potential of even the best quality app is enhanced when the child uses it with adult-guidance.

Learning occurs when the learner is active rather than passive

Active learning occurs when the learner is “minds-on”[4] meaning that the app stimulates active learning by the child. Tablets encourage more active engagement than other forms of media, such as television or traditional books, given the interaction children have with the tablet screen. We caution, however, that it is easy to mistake the physical movements that children make when using electronic devices as active learning because of action. Learning does not occur through the finger – it occurs through active comprehension and mental manipulation whether or not the child taps or swipes.

Learning occurs when the learner has to mentally manipulate ideas, see similarities and differences between new concepts and existing knowledge, and incorporate this new information into a more comprehensive understanding. This is true in many contexts for varied learners.[5,6] When evaluating the educational potential of an app, it is important to consider the minds-on nature of the learning activity.

Learning occurs when the learner is engaged (not distracted)

Technology has transformed the creation of educational content for children. Children can watch a lion in an actual habitat rather than read about it or see a static picture. Children can interact with letters and words by dragging letters around the screen and hearing how sounds work. Concurrently, these technological enhancements have the potential to distract children from learning and developers from the educational goal. All too often, developers prescribe to the “more is better” framework and inundate the child with “bells and whistles” that, while entertaining, distract children from the learning goal.

Young children may be particularly susceptible to this distraction[7] and the negative impacts of distracting stimuli

have been found with even low-tech pop-up books.[8,9] In a recent study investigating parent-child interaction with electronic books versus their traditional counterparts, researchers found that parents used more directives and asked fewer questions with electronic books; furthermore, 3-year-olds' story comprehension suffered.[10] Therefore, multimedia enhancements must be evaluated as a possible benefit or harm.

Learning occurs when the content is meaningful

Children can learn anything – from the names of animals to the characteristics that make mammals different from reptiles. However, this learning must occur in contexts that connect meaningfully to children's lives.[11] When selecting or creating apps, it is crucial that children do not just learn that the triangle on the screen is a triangle but that the piece of pizza in front of them resembles a triangle, too. The idea that meaningful learning has greater educational potential than rote learning is not limited to apps and implicates learners of all ages. By engaging deeper levels of processing, greater learning occurs. Apps should help children see lessons beyond the apps and even beyond the screen.

Learning is maximized with social interaction

While one of the attractive features of tablets is that children, from an early age, can use devices independently, research repeatedly shows that social interaction supports learning.[12] Apps should support, rather than replace, this interaction.[13] Increasingly, app developers are beginning to promote off-screen or hybrid experiences where children play an app together or parents are included in the app experience. In some apps the technology requires children to work together to play games or solve problems off-screen with the device playing moderator instead of partner.

Guided exploration towards a learning goal is best

Lastly, the educational potential of apps is maximized within a context of guided exploration toward a learning goal. For decades, the debate has raged about the best context for learning, with extremes ranging from direct instruction in which the adult 'deposits' information into the children to free play where children are given independence to explore the world. In guided play[14,15] the child is given an active and primary role but a more knowledgeable partner or adult guides and supports the child's learning. There is evidence that guided play may be even better than either of the extreme contexts in some domains (e.g., language,[16] space,[17]). This method may help children establish a particularly prepared, flexible and active mindset that promotes active, engaged, meaningful, and socially interactive learning.[18]

When evaluating or designing educational apps, it is crucial to go beyond the content itself. It is not enough to ask whether the content appears educational; it is important to examine how the app supports active learning by the child.

Research Gaps

While apps have educational potential, the field must continue to investigate under what circumstances and in which contexts material should be presented to children across development (e.g., formal vs. informal contexts, group versus solo-use, guided or independent learning). Further, it is an open question as to how child characteristics might impact the educational potential of apps. For example, are apps equally beneficial to

children across age, ability levels, socioeconomic level, and learning styles? This is especially important when considering the youngest learners (under the age of 2).

Conclusions

As apps are added to the marketplace and we move beyond this first phase of app development, it is crucial that educators, parents, policy makers, and app developers use the science about how children actually learn to guide the creation and evaluation of apps. While 170,000 apps may not have equal educational benefit, apps that promote guided exploration with active, engaged, meaningful, and socially interactive methods will harness the power of the devices already in the homes of most children. In this way, apps with a learning goal could promote truly beneficial and educational experiences across all socio-economic levels. Although many empirical questions remain, the literature suggests that apps likely have educational potential but that their adoption should be met with a cautious outlook informed by the science of learning.

Implications for Parents, Services, and Policy

While technology use is often met with either widespread adoption or rejection in both homes and schools, evidence suggests that older children can indeed learn from technology and that this use may have inherent benefits. However, given the facts that no established board evaluates the educational potential of apps and that the number of so-called educational apps are in the hundreds of thousands, it is crucial for parents, service providers, and policy makers to be given evidence-based guidelines that can be used to evaluate the educational potential of apps. Data from the Science of Learning offers a roadmap to evaluate these apps to guide their decisions: specifically, ask whether apps inspire active, engaged, meaningful, and socially interactive experiences that provide guided exploration towards a learning goal.

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