Journal of Health Informatics in Developing Countries

http://www.jhidc.org/

Vol. 14 No. 1, 2020

Submitted: December 18th, 2019 Accepted: February 1st 2020

The effect of electronics on the growth and development of young children:A Narrative Review

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Abstract

Background: The long-term usage of electronic devices produces negative effects on the growth and development of the child. Frequent and regular usage of electronics without the supervision of caregivers may be associated with delayed growth and development among young children. A plethora of studies has demonstrated heavy usage of electronic gadgets that affects the child's psychological, mental and behavioral aspects of the development, although the findings from the literature are not synthesized. Hence, the objective of this review was to appraise and synthesize the existing literature on the effects of electronics on the growth and development of young children.

Methods: We searched for different databases such as Google Scholar, PubMed, CINAHL and Science Direct to search and retrieve articles. All English articles published in developed and developing countries from 2000 to 2018 were included in this study. Primary and review articles were examined for information pertinent to the objective. Findings from both quantitative and qualitative studies were reviewed and included. After doing a comprehensive search of all eligible studies, we included 15 full-text articles in this review.

Findings: The existing review of the literature demonstrated that children spend most of their time on different gadgets like telephone, mobile phone, radio, TV, games, Xbox, iPod, and stereo system. Children use gadgets for various purposes like playing games, watching videos, listening to songs, chatting with their friends, browsing different websites. The findings of the study regarding the effect of electronic gadgets on the child's growth and development are mixed. Some studies show that children might be benefited from gadgets, however, studies also reveal that usage of gadgets might have negative effects on the growth and development of children.

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Conclusion: It is concluded that as the gadgets are increasing day by day, it is making children more addicted to technology. The usage of gadgets might be beneficial to some extent, however, excessive usage may lead to adverse outcomes among young children. Thus, it is important to take action to prevent children from watching excessive electronic gadgets under the proper supervision of caregivers.

Keywords: Electronic gadgets; young children; growth and development.

1. Introduction

The technology has been growing rapidly. In recent years, electronic games, home computers, and the Internet have assumed an important place in our lives [1].Various digital media have emerged showing different features with all the exciting sensations offered to the consumers [2]. Technology is very easy to find even in rural areas due to the low prices with sufficient quality [3]. The gadget is a technology product that has currently become a primary need for most people [4]. In 2013, daily mail reported that 29% of children at an early age can easily use gadgets and the remaining 70% are the master by primary school age [5]. According to the USA Centers for Disease Control and Prevention, an average child spends about 8 hours a day watching electronic screens [6]. Children who frequently use technology often ignore their surroundings [7]. They prefer facing sophisticated technology they have than playing with their peers in the playground or the environment surrounding them [8]. As a result, social communication between children and the environment reduces [9].

The use of gadgets in everyday life has an impact on children's behavior [5]. In the proliferating world of technology, children cannot escape the effect of using gadgets [5]. During early childhood, children experience development at the stage of exploring and interacting directly with their surroundings [10]. They are usually happy with the new things they get through playing activities [11]. They also often play and satisfy their curiosity through gadgets, because gadgets are interesting to them especially with the online game application, interesting features, and sounds, therefore, they end up spending most of their day playing gadgets [12]. Even though children of their age must play and mingle with their peers [13].

As children are growing older the use of gadgets also increases, which in turn can cause both positive and negative effects on the overall growth of the children [14, 15]. For instance, too much gadget use can affect the long-term vision problem [16]. Also, it increases the chances of

myopia among children when they spend about 8 hours daily on gadgets [17]. When people use electronic screens, they blink less. On average, a person blinks about 15 times in a minute [5]. Due to the high attention required while using an electronic screen, this rate can drop to less than 5 times in a minute [5]. Moreover, usage of gadgets also causes anxiety, depression, attention deficits, learning problems and effects of the growth of a child such as a delay in language development mainly during early childhood development [18].

The impact of electronics and televisions on young children is increasingly becoming the focus of research in recent years. The studies have shown a negative impact of electronics on the young child's psychological, mental and behavioral aspects of the development.Several studies have demonstrated that children who use electronic gadgets excessively are more likely to face growth and development problems, although the findings from the literature are not reviewed and synthesized. Therefore, we planned to undertake a narrative review to study the findings on the effects of electronics on the growth and development of young children. Hence, the objective of this review was to appraise and synthesize the existing literature on the effects of electronics on the growth and development of young children.

2. Material and Methods

We carried out an electronic systematic literature search to study the effects of electronic gadgets on the language development of children in developing and developed countries. The criteria to define a developing and developed country were chosen by guidelines based on World Bank's 2016 country classification [19].

2.1 Inclusion and Exclusion Criteria

To address our study question, a study was considered eligible for inclusion if it was a primary research paper in a peer-reviewed journal, published in the English language, and described primary epidemiological research from 2000 to 2018 concerning the effect of any type of electronic item. We grouped eligibility criteria into four major categories including population, intervention, outcome, and settings.

2.2 Information sources and Search Strategy

We searched a range of electronic bibliographic databases: PubMed through the National Center for Biotechnology Information (NCBI), Medline and Embase through Ovid, Cochrane Library through Wiley Inter-science, Google Scholar, SCOPUS through Elsevier, and Science Direct from 2000 to 2019. Within these databases, we searched relevant journals such as The Lancet, British Medical Journal, Pediatrics, Child Development, Journal of Child Psychology, Journal of Education Psychology, Nature, PLOS-Medicine, Children and Society, Journal of Child Language, Journal of Child and Adolescence, Child Care Health and Development, and Annals of Internal Medicine.

We conducted a literature search and scanned abstracts for the results for potentially relevant studies before retrieving the full articles. The primary outcome of the review was a child's growth and development. We grouped search terms into four major categories of interest according to PICO criteria: population, intervention, outcome, and comparison group. We utilized a combination of Medical Subject Heading (MeSH) keywords, and text words, which were clustered into four major categories including population, intervention, outcome, and settings. Most common search terms appearing in abstracts and titles included “electronic gadgets AND language delay”, “Mobile phone”, “TV”, “I-Pad”, “computers”, “media”, “electronic items OR cognitive development”, “television OR growth”, “computers OR growth”, “television AND development” and “language development delay AND electronics”, “gadgets AND children’s growth”.

2.3 Study Selection

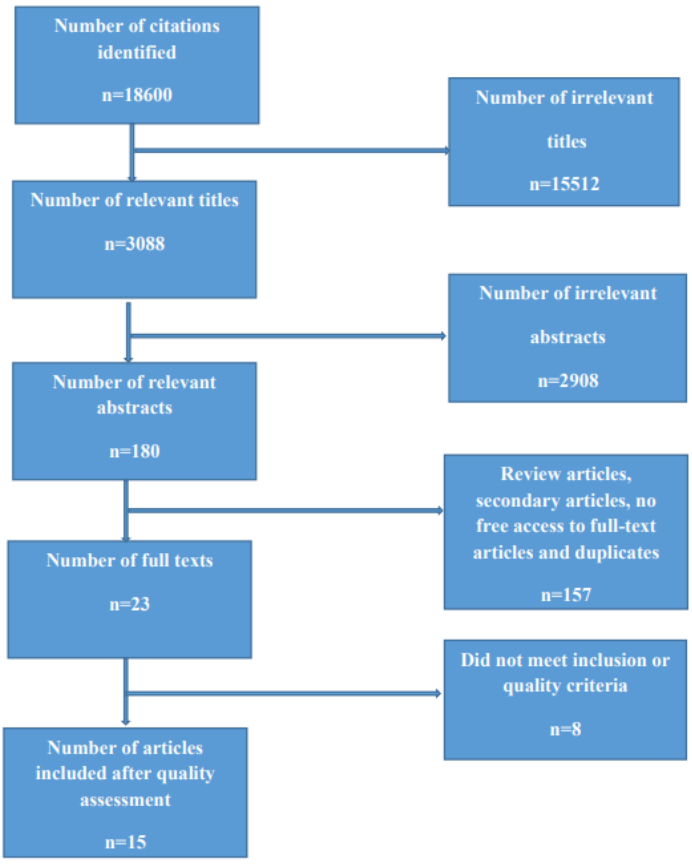
The searched articles were first screened by titles, then by abstracts, followed by a full-text assessment. Articles that did not meet inclusion criteria were excluded. As a result, our initial search identified 18600 citations; however, 15512 articles had irrelevant titles. Of the remaining 3088 articles with relevant titles, we reviewed abstracts and found 180 relevant abstracts. Upon reviewing abstracts, 157 articles were removed because either we did not have access to full-text articles or these were the review or secondary articles or their duplicates had also been found in some other database. Hence, we were able to retrieve full texts for 28 articles, which were assessed for eligibility criteria and quality using the Newcastle-Ottawa Scale for

different study designs. Finally, 15 articles met the required criteria for quality with a high score and were included in the review as shown in Figure 1.

2.4 Data Abstraction

Potentially relevant articles were imported into a single Endnote file, where each study was reviewed. The abstracts which did not explicitly measure the effects of electronics on a child's language development were excluded. Finally, full-text copies of the remaining relevant articles were obtained and scrutinized. Articles that met our inclusion criteria were abstracted and summarized using a standardized form. Besides, we searched their reference lists for further papers to avoid missing any relevant articles.

Figure 1: Flow chart summarizing the identification and selection of papers for review



3. Results of the Narrative Review

The findings of the narrative review revealed that the young children who watch TV excessively or spend more time operating electronic items such as smartphones, and tablets are

more likely to experience problems in the acquisition of expressive language. Furthermore, these children also suffer from other cognitive delays and may be at increased risk of learning disabilities later in their lives [5]. Children learn to talk and communicate in their daily routines to make frequent interactions with others [20]. They need more time to talk with their parents, so they can learn new words and learn how to communicate [5]. Similarly, the findings of another study support the importance of content and program type when describing media effects [21] This study found that children at 30 months of age watching Teletubbies were related to fewer vocabulary words and smaller expressive language scores [21]. On the other hand, Donna Hermawati, et al found that early exposure of electronic media (< 2 years old) impacts language, but findings are inconclusive [22]. This study showed that children who spent viewing ≤ 3 hours per day had language delay and short attention span, while children who spent viewing ≥ 3 hours per day had a language delay, short attention span, and hyperactivity [22].

One more study investigated the hypothesis that background television affects interactions between parents and very young children. In this study, 51 children (12-, 24-, and 36-month-old), each accompanied by 1 parent, were observed for 1hour of free play in a laboratory space resembling a family room [23]. For half of the hour, an adult-directed television program played in the background on a monaural television set. During the other half hour, the television was not on. Both the quantity and quality of parent-child interaction decreased in the presence of background television [23]. These findings suggest one way in which early, chronic exposure to television may have a negative impact on development [23].

Likewise, another study found the effects of television watching on the Communicative Development Inventory (CDI) [24]. Among infants (age 8 to 16 months), each hour per day of viewing baby DVDs/videos was associated with a 16.99-point decrement in CDI score in a fully adjusted model. Among toddlers (age 17 to 24 months), there were no significant associations between any type of media exposure and CDI scores. This study further found that the amount of parental viewing with the child was insignificantly associated with CDI scores in either infants or toddlers [24].

A recently conducted study in Mangalore, and Karnataka found the effect of gadgets on children's behavior, academic performance and overall health [18]. The authors of the study found that 69% of the students like to use gadgets at night before sleeping, of which 59% of the children complained of frequent headaches in the morning along with some difficulty in seeing

the blackboard from backbenches [18]. Of these, 53% of the children had difficulty in concentrating during classes or at home while studying, hence reporting an overall fall in their grades [18]. Likewise, one more study revealed that there is an effect on electronic devices at the scientific level of students [19]. Increasing hours of use of electronic devices decreases the scientific level of students irrespective of their gender [19]. Another study conducted in Indonesia found the negative effects of gadgets. More specifically, the study showed that the majority of children in Indonesia spend time playing gadget [26]. The study seeks to explain the use of gadget toward early childhood speaking ability. The results obtained in this study indicate that the use of gadgets can delay the children speaking ability; especially children aged 3-4 years [26].

One more study provides empirical evidence that watching a 9-minute episode of a fast-paced television cartoon immediately impaired young children's executive function relative to watching an educational television show or drawing [27]. Children in the fast-paced television group scored significantly worse than the others despite being equal in attention at the outset, as indicated by the parent report [27]. A study conducted in Canada found that after adjusting for preexisting individual and family factors, every additional hour of television exposure at 29 months corresponded to 7% and 6% unit decreases in classroom engagement) and math achievement, respectively. Furthermore, the same exposure lead to 10% unit increases in victimization by classmates; 13% unit decreases in time spent doing weekend physical activity; 9% unit decreases in activities involving physical effort; higher consumption scores for soft drinks and snacks by 9% and 10% respectively; and 5% unit increases in body mass index. Preschool increments in exposure also made a unique contribution to developmental risk [28].

Another study conducted in Quebec Canada found that daily television viewing at 29 months predicted decreases in receptive vocabulary, number knowledge scores, classroom engagement, and gross motor locomotion scores, as well as increases in the frequency of victimization by classmates [28]. Hence, this study concluded that increases in total time watching television at 29 months were associated with subsequent decreases in vocabulary and math skills, classroom engagement (which is largely determined by attention skills), victimization by classmates, and physical prowess at kindergarten [28].

Likewise, the results from one more study demonstrated that at one and 3years of age, children were viewing an average of 2.2 and 3.6 hours of television per day, respectively [29].

When adjusting for confounders such as maternal age, education, gender, race and gestational age, logistic regression models indicated hours of television watching at age 1 and 3 were associated with attentional problems later in life [29]. These results demonstrate that children as young as 1 and 3years of age are spending a considerable proportion of their time watching television and the children who viewed more television are more likely to have attentional problems later in their life [29].

An additional study conducted in Southern Taiwan found that viewing television increased the risk of delayed cognitive, language, and motor development in children who were frequently exposed to television [30]. Cognitive, language and motor delays in young children were significantly associated with how much time they spent viewing television [30]. Moreover, this study also revealed that the type of care providers was critical in determining the television-viewing time of children [30]. Similarly, one more study found that viewing of educational television before age 3 was not associated with attentional problems 5 years later [31]. However, viewing of either violent or non-violent entertainment television before age 3 was significantly associated with subsequent attentional problems, and the magnitude of the association was large. Viewing of any content type at ages 4 to 5 was not associated with subsequent problems [31].

In contrast to these studies, a study in the USA showed reverse findings. This particular study found that children who had access to a computer performed better on measures of school readiness and cognitive development, controlling for children's developmental stage and family socioeconomic status [19]. The data in the current study did not suggest a relationship between computer experience and visual-motor or gross motor skills among the participating children [19]. Similarly, one more study from the United States found contradictory findings regarding television on different children's outcomes. The study found that sustained television viewing was associated with behavioral outcomes. Concurrent television exposure was associated with fewer social skills [32]. For children with heavy television viewing only in early childhood, there was no consistent association with behavioral or social skills outcomes. Having a television in the bedroom was associated with sleep problems and less emotional reactivity at 5.5 years but was not associated with social skills [32]. Another longitudinal Study in Australia followed an Australian cohort born in 1999/2000 [33]. Skills and computer usage information were collected when children were approximately 5 and 7 years old [33]. The study indicates that for cognitive

skills computer time has a positive effect [33]. For non-cognitive skills, the evidence is mixed, the effect depending on the score and the age of the children [33].

Similarly, results from one study conducted in Indonesia found that the use of gadgets could help children to enhance their skills [5]. The use of gadgets in a constructive way can lead to healthier and efficient minds [5]. This study found mixed effects of gadgets on children's outcomes such as positive effects for children's cognitive and motor skills and negative effects on children's character and learning problems [5].

4. Conclusion

A plethora of negative and positive effects of electronics such as television, computers, and smart phones have been studied in the literature. Although the use of electronic gadgets is not the sole leading cause of health problems, they do contribute significantly to a variety of mental and physical health disorders. The findings from the literature are mixed with most of the findings showing the negative effects of electronics on the growth and development of children. However, the effect of electronics on children's outcomes depends upon the number of hours watching television or working on the computer as well as the type of program being watched. Furthermore, the results studies vary from one geographic to another geographic area.
In the fast-growing modern world, it may be hard to keep children away from gadgets, however, children can be encouraged to use gadgets in the educational field or study purpose can lead to a drastic change in their lives. It can help them to enhance their skills.

The use of gadgets in a constructive way can lead to healthier and efficient minds. The optimal use of electronic devices among children can be done by supervising and monitoring children at regular intervals. It may be difficult to determine the time children spend using electronic devices. However, various mechanisms can be adapted to avoid the abuse of electronic devices by appropriate monitoring and control mechanism. This will eventually avoid the addiction to electronic devices and their associated adverse outcomes among children. The available evidence on the effect of gadgets is mixed and mainly on the effects of electronic devices on early children's outcomes; therefore, more longitudinal studies are indicated on how gadgets affect children in their later years of life.

Declarations: Since this was a review of literature, therefore, ethical review and consent is not applicable.

Availability of data and materials: All cited articles are available online.

Competing interests: The authors declare that they have no competing interests.

Funding: Not applicable

References

1. Subrahmanyam K, Greenfield P, Kraut R, Gross E. The impact of computer use on children's and adolescents' development. *Journal of Applied Developmental Psychology*. 2001 Jan 1;22(1):7-30.
2. Heinonen K. Consumer activity in social media: Managerial approaches to consumers' social media behavior. *Journal of Consumer Behaviour*. 2011 Nov;10(6):356-64.
3. Ozor N, Alumona B, Mbam B. Rural Women's Access and use of Information Communication Technologies (ICTS) in Nsukka Agricultural Zone of Enugu State. *International Journal of Communication: An Interdisciplinary Journal of Communication Studies*. 2017 Aug 8;9(1).
4. Valacich JS, Wang X, Jessup LM. Did I buy the wrong gadget? how the evaluability of technology features influences technology feature preferences and subsequent product choice. *MIS Quarterly*. 2018 Jun 1;42(2):633-44.
5. Sundus M. The impact of using gadgets on children. *Journal of depression and anxiety*. 2018;7(1):1-3.
6. Nirwana N, Mappapoleonro AM, Chairunnisa C. The Effect of Gadget Toward Early Childhood Speaking Ability. *Indonesian Journal of Early Childhood Education Studies*. 2018 Nov 23;7(2):85-90.
7. Wilmer HH, Sherman LE, Chein JM. Smartphones and cognition: A review of research exploring the links between mobile technology habits and cognitive functioning. *Frontiers in psychology*. 2017 Apr 25;8:605.
8. Suhana, M. *Influence of Gadget Usage on Children's Social-Emotional Development.* Paper presented at the International Conference of Early Childhood Education (ICECE 2017). 2017.
9. Neufeld, G., & Maté, G. *Hold on to your kids: Why parents need to matter more than peers*: Vintage Books Canada. 2013.
10. Sarwar M, Soomro TR. Impact of smartphone's on society. *European journal of scientific research*. 2013 Mar 2;98(2):216-26.
11. Nurhayati, E., & Astuti, K. *Children's learning of Dolanan songs in the digital era.* Paper presented at the 21st Century Innovation in Music Education: Proceedings of the 1st International Conference of the Music Education Community (INTERCOME 2018), October 25-26, 2018, Yogyakarta, Indonesia. 2019.
12. de Lemos, C. M., Oliveira, C. M. P., Neves, S. A. C., Teixeira, V. M. M. M., Branco, F., & Au-Yong-Oliveira, M. *Could Children Be Influenced by Technology? An Exploratory Study in Portugal.* Paper presented at the World Conference on Information Systems and Technologies. 2019.

13. Kapp, K. M. *Gadgets, games and gizmos for learning: Tools and techniques for transferring know-how from boomers to gamers*: John Wiley & Sons. 2007.
14. Gowthami, S., & Kumar, S. Impact of smartphone: A pilot study on positive and negative effects. *International Journal of Scientific Engineering and Applied Science (IJSEAS),* 2016; *2*(3), 473-478.
15. Hegde, A. M., Bhandary, M., & Balraj, K. Negative Impacts of Electronic Gadgets on School Going Children in Dakshina Kannada District. *Journal of Advanced Medical and Dental Sciences Research,* 2019; *7*(11).
16. Subrahmanyam, K., Greenfield, P., Kraut, R., & Gross, E. The impact of computer use on children's and adolescents' development. *Journal of Applied Developmental Psychology,* 2001; *22*(1), 7-30.
17. Tarutta, E., Proskurina, O., Tarasova, N., & Markosyan, G. Analysis of risk factors that cause myopia in pre-school children and primary school students. *Health risk analysis;* 2019; (3), 26.
18. Hegde, A. M., Suman, P., Unais, M., & Jeyakumar, C. Effect of electronic gadgets on the behaviour, academic performance and overall health of school going children-a descriptive study. *Journal of Advanced Medical and Dental Sciences Research,* 2019; *7*(1), 100-103.
19. Li, X., & Atkins, M. S. Early childhood computer experience and cognitive and motor development. *Pediatrics,* 2004; *113*(6), 1715-1722.
20. Foley, J., & Thompson, L. *Language learning: A lifelong process*: Routledge. 2017.
21. Zhaoping, L., & Meng, G. Article Menu Download PDF [PDF] Article Metrics Cite Share Related Articles Dichoptic Completion, Rather than Binocular Rivalry or Binocular Summation. *i-Perception,* 2011; *2*(6), 611-614.
22. Hermawati, D., Rahmadi, F. A., Sumekar, T. A., & Winarni, T. I. (2018). Early electronic screen exposure and autistic-like symptoms. *Intractable & rare diseases research, 7*(1), 69-71.
23. Kirkorian, H. L., Pempek, T. A., Murphy, L. A., Schmidt, M. E., & Anderson, D. R. The impact of background television on parent–child interaction. *Child development,* 2009; *80*(5), 1350-1359.
24. Zimmerman, F. J., Christakis, D. A., & Meltzoff, A. N. Associations between media viewing and language development in children under age 2 years. *The Journal of pediatrics,* 2007; *151*(4), 364-368.
25. Ali, A. H., Salman, M. D., Saleh, R., Fayadh, E. N., abd Al-Hameed, S., Falah, H., . . . Ali, A. H. *The effect of the electronic devices on children.* Paper presented at the Journal of Physics: Conference Series. 2019.

26. Nirwana, N., Mappapoleonro, A. M., & Chairunnisa, C. The Effect of Gadget Toward Early Childhood Speaking Ability. *Indonesian Journal of Early Childhood Education Studies*, 2018; *7*(2), 85-90.
27. Lillard, A. S., & Peterson, J. The immediate impact of different types of television on young children's executive function. *Pediatrics,* 2011; *128*(4), 644-649.
28. Pagani, L. S., Fitzpatrick, C., & Barnett, T. A. Early childhood television viewing and kindergarten entry readiness. *Pediatric research,* 2013; *74*(3), 350-355.
29. Mehmet-Radji, O. Early television exposure and subsequent attentional problems in children. *Child: Care, Health and Development,* 2004; *30*(5), 559-560.
30. Lin, L.-Y., Cherng, R.-J., Chen, Y.-J., Chen, Y.-J., & Yang, H.-M. Effects of television exposure on developmental skills among young children. *Infant behavior and development,* 2015; *38*, 20-26.
31. Christakis, F. J. Z. a. D. A. Associations Between Content Types of Early Media Exposure and Subsequent Attentional Problems. *Pediatrics*, 2007; *120*.
32. Mistry, K. B., Minkovitz, C. S., Strobino, D. M., & Borzekowski, D. L. Children's television exposure and behavioral and social outcomes at 5.5 years: does timing of exposure matter? *Pediatrics,* 2007; *120*(4), 762-769.
33. Fiorini, M. The effect of home computer use on children's cognitive and non-cognitive skills. *Economics of Education review,* 2010; *29*(1), 55-72.