Digital technologies in early childhood education

Digital media and devices have become ubiquitous in the lives of children and families in New Zealand and around the world. They can provide exciting opportunities for playing, learning, creating, and communicating, but the increase in their use has been accompanied by concern about the impact of digital technologies and media on children's development. Research finds that children in New Zealand use digital devices for recreation every day, and that almost 90% of children aged 1 to 14 exceed Ministry of Health guidelines for screen time limits (which specify no screen time for children under 2, less than an hour a day for children aged 2 to 5, and less than two hours per day for children aged 5 to 17) [1]. While governmental education authorities and employers promote the expansion of technology use in early childhood settings and focus on the importance of developing children's digital skills, the impact of screen time on children's emotional, social, and cognitive development is a concern for teachers and parents, fuelled by (often negative) media reports.

What are digital technologies and screen time?

In this review we use the terms 'digital technologies' and 'screen time'. Digital technologies include devices such as tablets, mobile phones, laptops and computers, but also technologies without screens, such as digital cameras, voice assistants, digital toys, smart (internet-connected) toys, walkie-talkies and activity trackers[2]. Digital technologies are often also platforms for children to engage with digital media and popular culture[3], including media franchises such as Peppa Pig and Thomas the Tank Engine.

Screen time is a term used to describe viewing media as well as interacting, creating, and learning with and through screen-based technologies, such as tablets, mobile phones, televisions, computers, and games consoles. Screen time is used as a way of measuring the extent of children's engagement with digital media. However, this is a rather simplistic construct[4] as it does not indicate which of the large variety of ways of interacting with and using these technologies is being used[5].

What concerns are there for children's development and wellbeing?

While the influence of screen time on children's development and behaviour is not well understood, many concerns have been raised about the possible negative impact on all areas of children's development. These include:

- physical development concerns related to the impact of poor posture and repetitive movements while using screens, increased time sitting still and decreased time in gross motor activity and skill development, and the associated risks of obesity.[6]

- cognitive development concerns which focus on the potential reduction in the range of learning opportunities children access, including opportunities for problem-solving and creativity, and verbal interactions with others[7]. A reduction in attention skills, behavioural regulation, and executive function skills[8] related to the use of screens are also concerns.

- emotional problems including addiction and depression as well as children being negatively affected by inappropriate content and advertising[9].

- social issues such as a lack of face-to-face interaction, social isolation, cyber-bullying[10], exposure to anti-social views[11], and predation[12].

- privacy and security concerns due to the way some internet-connected toys and wearable products use cameras, sensors, microphones and voice-recognition software to constantly record, store and send information over the internet about where, when and how children are using them[13].

- concern for children's play skills, related to the perception that technology, and play with trademarked toys and popular culture, are displacing more traditional play activities[14].

Without clear evidence of absence of harm, many researchers and public health agencies take a cautious approach and push for minimal use of digital technologies and screens, particularly for very young children.

Drawing conclusions about the impact of digital technologies on children's development

It is not easy to draw conclusions about children's use of digital and screen-based technologies and the associated impact of these technologies on children's development and wellbeing because of the range in the use of technologies, as well as the variation in children's development patterns and the influence of other contextual factors[15]. In addition, there is a shortage of research examining how families use digital media, on how younger children engage with digital media, and children's perspectives on digital technologies[16]. Most research that exists investigates adult concerns and is focused on television viewing, a very passive form of screen time, rather than newer, and more interactive technologies. There is very little research on non-screen-based digital technologies, such as digital toys, on children's development.

Claims about the detrimental effects of screen-based technologies rely heavily on observational research and can only describe correlations rather than direct, causal relationships, as it is very difficult to isolate the impact of screen time from the multitude of other factors influencing children's development[17]. The impact of screen time may be confounded with other issues, such as inadequate sleep, which also impacts on children's behaviour[18], development and learning, or with increased sedentary behaviour[19]. A correlation of a negative effect with extended screen use does not mean that screen time causes a particular issue. For example, while playing video games correlates with more attention problems in children, this might be because children with attention difficulties are more likely to play video games[20]. It can also be difficult to ascertain the learning trajectory that would have occurred without use of digital media. For example, when a group of infants that had repeatedly viewed an educational DVD to learn a specific set of words were compared to a control group who had not viewed the video, both groups were found to have made similar vocabulary gains[21].

Children's technology use is heavily influenced by their context in diverse ways that a measure such as amount of screen time cannot capture. Screens can serve many different functions, and there is enormous variation in the way screens are used, the type of device and content that is explored, and the connections with others that are apparent (or not)[22]. However, in the research and commentary on appropriate interactions with digital technologies, screen time is rarely analysed to reflect these differences in activity. For example, screen time might include the television being on in the background (not being attended to), children watching and discussing a television programme with a friend, sibling or parent, children using a screen to make a video call to grandparents using a tablet, or children scrolling through photos on a mobile phone[23].

These difficulties in researching the impact of digital technologies on children's development are reflected in the conflicting research findings in this area. For example, it is entirely possible to find research on children's attention and hyperactivity that report no relation to screen time, as well as research that reports a slightly increased risk of hyperactivity related to screen use[24].

What broad conclusions can be drawn from existing evidence?

Despite a large amount of ambiguity among studies, it is possible to identify some broad conclusions from the research. In general, screen time for children under 5 is found to negatively affect development, but the effects are mainly mild[25]. The strength of the effect seems to relate to the content and presentation of screen-based activity[26]. Cartoons and other non-educational and fantastical programmes are thought to negatively affect young children's executive function skills, particularly self-regulation skills and attention, which may be due to the difficulties young children have processing unrealistic and unexpected events[27]. It is also possible that children may adapt to the high levels of stimulation of noisy and fast-paced media, which may make it more difficult for them to focus attention on more mundane real-life activities[28]. Another possibility is that using screens is not as beneficial for children's learning and development as other play activity, with time on screens reducing time for other kinds of play[29].

There is emerging research showing that increased screen use leads to structural changes in children's brains related to executive function, language, and literacy[30]. Digital media use for children under two years old shows more convincing evidence of harm, while evidence of benefits of media use are limited[31]. A range of studies indicate that screen time during infancy is associated with negative impacts on executive function. Daily exposure to screens is linked to higher levels of fussiness, greater difficulty controlling emotions, and poorer performance on tests of thinking, problem-solving and language ability[32]. However, there is some variation across the findings of the different studies.

As children get older, the risks are shown to be smaller. One large scale study investigating relationships between screen time and academic development, mental health, behaviour, sleep and friendships in 9 and 10 year-olds showed that, although screen time is associated with poorer academic performance, poorer mental health, poorer sleep and increased behaviour problems, the effect sizes were modest, and there were also some positive correlations, such as a higher quantity and quality of relationships with peers[33]. Educational programmes and games, which are appropriately paced and interactive, are also found to support young children to learn literacy, mathematics and science concepts[34]. Gaming has been found to encourage the development of executive function skills such as switching between tasks and ignoring distractions[35].

What does this mean for determining a digital technology pedagogy in early childhood?

While many public health organisations provide guidelines about the maximum amount of screen time for different age groups, these guidelines do not take into account the content of the screen time and the context in which screens are being used. There is not enough scientific evidence to determine how much screen time is actually harmful[36]. It is instead more important to carefully differentiate between the different forms of digital media available and focus on finding ways to engage with screens in ways which minimise the possibility of negative effects and emphasise positive learning opportunities[37].

Further reading

Paulich, K. N., Ross, J. M., Lessem, J. M., Hewitt, J. K. (2021). Screen time and early adolescent mental health, academic, and social outcomes in 9- and 10- year old children: Utilizing the Adolescent Brain Cognitive Development (ABCD) study. PLOS ONE https://doi.org/10.1371/journal.pone.0256591 [open access]

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Endnotes

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33 Paulich, K. N., Ross, J. M., Lessem, J. M., & Hewitt, J. K. (2021). Screen time and early adolescent mental health, academic, and social outcomes in 9- and 10-year old children: Utilizing the Adolescent Brain Cognitive Development (ABCD) study. PLOS ONE

34 Wilkinson et al. (2021)

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