Early Childhood Educ J (2016) 44:127–134
DOI 10.1007/s10643-015-0695-4

Singaporean Parents' Views of Their Young Children's Access and Use of Technological Devices

Marjory Ebbeck · Hoi Yin Bonnie Yim · Yvonne Chan · Mandy Goh

Published online: 12 February 2015

Abstract Debates continue about the access young children have to technological devices, given the increasingly accessible and available technology in most developed countries. Concerns have been expressed by parents/caregivers and researchers, and questions have been raised about possible risks and benefits of these devices on young children who, in some instances, may be accessing these devices daily. Levin (2013) states that it is as if children are being remote controlled by the scripts of others (television, videos, electronic toys) which undermine children's abilities to create their own learning scripts. This study investigated 1,058 parents'/caregivers' views of their children's (aged below 7 years) access and time spent on technology devices. Parents'/caregivers' views on risks and benefits associated with the use of the emerging touch screen devices were also sought. The context for this research was Singapore which, according to a survey in 2012 by Ericsson, has one of the highest usage rates of smartphones and touchscreen devices in the world. The findings may help researchers, parents/caregivers and teachers to further their understanding of young children's development in the twenty-first century.

Keywords Touch screens · Parents · Singapore · Children

M. Ebbeck (✉)
School of Education, University of South Australia, Magill Campus, St Bernards Road, Magill, SA 5072, Australia
e-mail: Marjory.Ebbeck@unisa.edu.au

H. Y. B. Yim
School of Education, Deakin University, Geelong Waurn Ponds Campus, Locked Bag 20000, Geelong, VIC 3220, Australia
e-mail: b.yim@deakin.edu.au

Y. Chan · M. Goh
SEED Institute, Devan Nair Institute for Employment and Employability, 80 Jurong East Street 21, #03-03, Singapore 609607, Singapore
e-mail: chanyy@seedinstitute.edu.sg

M. Goh
e-mail: gohlm@seedinstitute.edu.sg

Introduction

Singapore is one of the most technological societies in the digital age. A recent study showed that it received the highest scores of any country for using ICT efficiently in government, and offered the fastest Internet speeds in the world (D'Agostino et al. 2012). Singapore is also one of the top performing countries in terms of information and communication technology (ICT) readiness, and with excellent digital infrastructures (Bilbao-Osorio et al. 2014). Most families have a range of technological devices that are accessible to their children (Infocomm Development Authority of Singapore 2013). How frequently these devices are accessed by young children is a matter of interest to educators, medical practitioners and parents. The National Association for the Education of Young Children's (NAEYC) position statement on technology and interactive media states that "young children live in a world of interactive media and they are growing up at ease with digital devices that are rapidly becoming the tools of the culture at home" (NAEYC 2012, p. 2).

Two decades ago there were debates about the role of technology in the early childhood curriculum (Barnes and Hill 1983; Cuffaro 1984, all as cited in Char 1990). It was argued that young children should not use computers because they were too complex for their level of understanding. In addition, numerous studies in the 1980s were launched in response to the fear that computers would draw

children away from traditional, concrete activities, and adversely affect peer social relations (Roe and Muijs 1998; Swaminathan and Wright 2003). Healy (1998) argued the need for young children to have human support and verbal interaction; the use of computers was damaging to young children's development and, therefore, their learning. Other possible negative outcomes have been identified, such as: irregular sleep patterns, behavioural issues, focus and attention problems, decreased academic performance, negative impact on socialisation and language development, and an increase in the amount of time young children spend in front of screens (Appel and O'Gara 2001; Brooks-Gunn and Donahue 2008; Cordes and Miller 2000; Lee et al. 2009; Vandewater et al. 2007).

To date, hot debates over technological devices for young children still exist, including concerns that children need to experience active learning involving real objects that they can manipulate (Armstrong and Casement 2000; Haugland 2000; Teng 2013; Yelland 1999). Furthermore, the emerging touch screen devices raise debates. Tisseron (as cited in Jakubek 2012) worries that apps (i.e. computer applications) fail to teach children properly to apprehend three-dimensional space, which is a key developmental milestone.

Wyness noted that "cyber children are developing skills that can enhance their productive capacities [and] they are creating social spaces for themselves" (2006, p. 175). He added that research showed that children do things with the family and their peers. The internet "expands their repertoire of social encounters" (p. 175). Other references supporting ICT add that it can facilitate communication between children, turn-taking and collaborative problem solving (Clements et al. 1993; Fatouros 1995).

Highfield (2010), commenting on young children's immersion in a technologically rich society, proposes that when used appropriately, digital play and the inclusion of techno toys can provide new opportunities to develop social skills and explore new situations. In addition, Mioduser et al. (2000) noted that the use of technology is motivating and can offer a way to break a cycle of failure to learn for children who struggle in learning to read.

Despite the differences in beliefs, many educators and parents understand that children will require technological competencies in order to succeed later as adults in the workplace. For example, in Australia, the early years learning framework learning outcome 5 states that "it is important that children are able to use information and communication technologies to access information, investigate ideas and represent their thinking" (DEEWR 2009, p. 44). In the USA, NAEYC (2012) adopted a position statement on technology and young children (3–8 years) that endorsed the use of suitable software for collaborative play, learning and creative expression.

It is acknowledged that parents are the first educators in children's lives (Berger 2008; Bredekamp 2011; Follari 2010). Although some parents are advanced and knowledgeable technology users themselves, this does not mean that they necessarily understand the full implications of the ICT products and services when used by young children (Clarke 2006, p. 8). This lack of understanding may, in turn, hinder their effectiveness when supervising or educating their children. Technology and media are tools that are effective only when used appropriately (NAEYC 2012).

Some recent evidence from physiotherapists, as reported by Meegan (2013), shows that children as young as 8 years are being treated for headaches, neck and shoulder pain and poor posture as they spend more time with screens, including mobile phones. The Australian Physiotherapists Association also reported upon by Meegan in this same article, agreed that there is an emerging physical problem, and it is a matter of getting the right balance between screen time and physical activity.

An educational perspective of Levin proposes that "today it is as if children are being remote controlled by the scripts of others (television, videos, electronic toys), instead of coming up with their own unique stories and problems to solve" (2011, p. 61). She labels this as "remote controlled childhood", further stating that this undermines children's ability to be inventive and promotes instead rote memorization or imitation of the scripts produced by others.

The Research Study

This study is part of a larger project which investigates the emerging roles and uses of technological devices by parents/caregivers and their children (aged under 7 years) in Singapore, with a particular interest in infants and toddlers (aged under 3 years). This paper reports on Singaporean parents'/caregivers' views of their young children's (under 7 years old) access and time spent on using technological devices. Eight devices were selected based on relevant international studies (Gorra et al. 2010; Zickuhr 2011), local research (Johnson and Christensen 2012), and the availability of those devices in Singapore during the research period. The eight selected devices included: (1) desktop; (2) laptop; (3) tablet PC; (4) personal digital assistant (PDA); (5) iPod/MP3 player; (6) smartphone; (7) touch screen tablet; and (8) eReader. This study did not deal with television viewing, which is another vast area of research on children's viewing patterns. In this study, parents'/caregivers' views on risks and benefits of the emerging touch screen devices in Singapore were sought.

Specifically, this project aimed to investigate the following four research questions:

1. What technological devices are used by children under age seven in Singapore?
2. What is the time duration spent on using different technological devices by children under the age of seven years in Singapore?
3. What are parents'/caregivers' views of risks of their children accessing the emerging touch screen devices?
4. What are parents'/caregivers' views of benefits of their children accessing the emerging touch screen devices?

Methodology

The design of the research was based on a quantitative approach (Johnson and Christensen 2012, p. 169). Data were collected by administering a questionnaire comprising open- and closed-ended questions. The questionnaire focused on gathering information about Singaporean parents'/caregivers' views on their children's access and time spent on technological devices, and their perceived risks and benefits of the emerging touch screen devices in Singapore. Such a data collection instrument was efficient for the large sample size of the current research study (n = 1,058), as it saved time, human and financial resources (Kumar 2011). A pilot test of the questionnaire was conducted using the think-aloud technique (Johnson and Christensen 2012), and the participants reported that no changes to the questions were necessary.

Participants

This study included a total of 1,058 adult-participants (297 males, 761 females). They were parents/caregivers of 1,559 children below seven years of age (814 males, 745 females). These children attended one of 34 child care centres in Singapore managed by a large non-government organisation. The majority of adult participants were parents (98.5 %), and a small proportion of them were caregivers (e.g. guardian or grandparent) (1.5 %). Most adult-participants were within the age range of 31–40 years old (69 %), and had attained university qualifications (45.2 %).

Procedure and Data Collection

Approval to conduct the study was obtained from the management committee of a large child care organisation including their ethics committee which approved the questionnaire and the procedures. As a follow up invitation, information letters were sent to parents/caregivers by email and hardcopy to Principals of 34 child care centres. Parents, caregivers and principals were invited to participate voluntarily in data collection, and they were also informed that they could refuse their participation in data collection without any explanation, penalty, or disadvantage to them. A total of 1,062 questionnaires were distributed to parents/caregivers, and parent/caregivers were invited to voluntarily and anonymously return them to a collection box in the reception counter of each centre within a period of 2 weeks (response rate 99.6 %).

Data Analysis

Quantitative data for children's access and time spent on technological devices was analysed using the statistical package for the social science (SPSS) version 22.0 software. Descriptive data reported in this paper examined patterns of children's access and time spent on technological devices in Singapore. Qualitative responses for parents'/caregivers' perceived risks and benefits were entered and analysed using the QSR NVivo version 10.0 software. Data were coded according to the four child development themes, namely (1) physical, (2) cognitive, (3) emotional, and (4) social. Responses in each theme had keywords selected and those with similar keywords and ideas were given the same code.

Findings of the Study

These are presented in relation to each research question as follows:

Question 1: What Technological Devices are Used by Children Under 7 Years of Age in Singapore?

Results show that smartphone (n = 695), touch screen tablet (n = 522) and laptop computer (n = 277) were the three technological devices most frequently used by children aged under 7 years (Fig. 1). Table 1 further shows that smartphone (25.8 %) and touch screen tablet (25.7 %) were most commonly used by children aged 5 years old. The same table also shows that eReader was widely used, particularly by 3-year-old children (33.3 %) and 6-year-old children (33.3 %). Desktop (32.9 %) and laptop computer (33.2 %) were more commonly used by 6-year-old children.

Question 2: What is the Daily Time Duration Spent on Using Different Technological Devices by Different Age Groups of Children?

Results show that parents/caregivers reported that their young children used technological devices for less than one hour per day (Fig. 2). The same figure also shows that children spent similar amounts of time per day on a

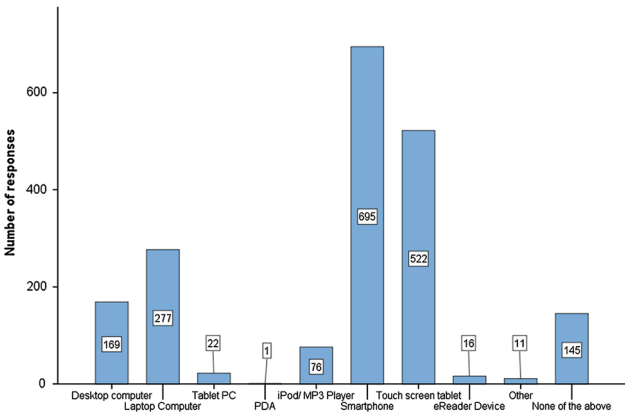

Fig. 1 Types of technological devices used by children <7 years of age

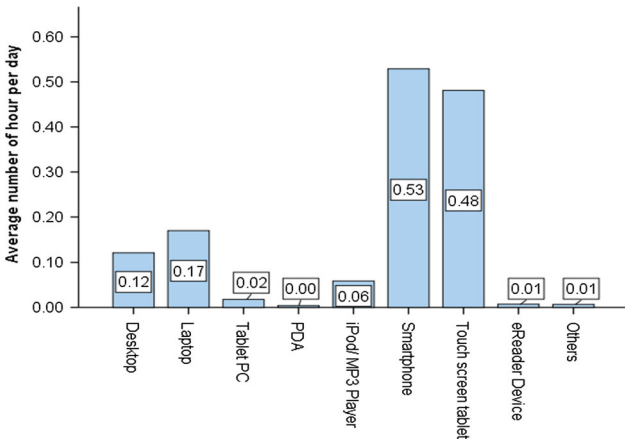

Fig. 2 Children's (<7 years of age) daily time spent (hour) on using technological devices

smartphone (0.5 h) and a touch screen tablet (0.5 h). Further, children aged under 7 years spent similar amounts of time on a laptop computer (0.2 h) and a desktop computer (0.1 h).

Figure 3 shows that, except for children aged under one year old, children at all age groups spent time on smartphones and touch screen tablets daily. Children aged 3 years old spent the largest amount of time on smartphone (0.6 h), as compared to other age groups. Children aged 5 years old also spent the largest amount of time in using touch screen tablets (0.6 h). Desktops (0.2 h) and laptops (0.2 h) were used most frequently by children who were six years of age.

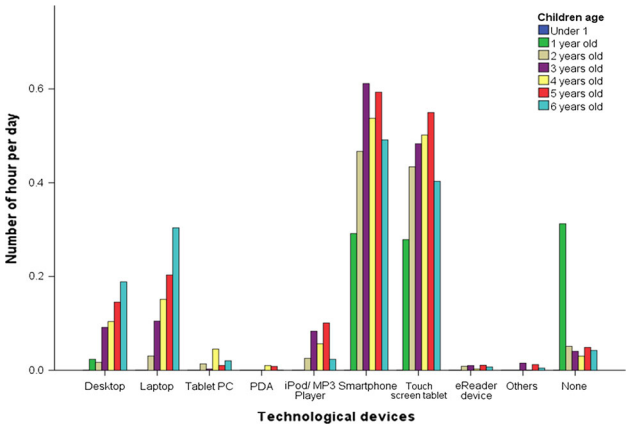

Fig. 3 Different age groups of children's daily time spent (hours) on technological devices

Question 3: What are Parents'/Caregivers' Views of Risks of Their Children Accessing the Emerging Touch Screen Devices?

A total of 1,484 qualitative responses were collected from parents/caregivers in regards to their views perceived risks of their children accessing the emerging touch screen devices. The majority of parents/caregivers identified that touch screen devices were most risky for children's intellectual (n = 816) and physical (n = 790) development. Table 2 summarises the three most frequent risks in each developmental domain as identified by parents/caregivers.

Table 1 Children's use of technological devices in different age groups

Child age	Desktop computer		Laptop computer		Tablet PC		PDA		iPod/MP3 player		Smartphone		Touch screen tablet		eReader devive		Other		None	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Under 1	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	1.40
1	1	0.60	0	0.00	0	0.00	0	0.00	0	0.00	10	1.50	10	2.00	0	0.00	0	0.00	16	11.60
2	4	2.60	13	4.90	1	5.00	0	0.00	6	9.00	73	11.00	50	10.00	1	6.70	2	20.00	28	20.30
3	18	11.60	27	10.20	3	15.00	0	0.00	14	20.90	137	20.60	103	20.60	5	33.30	2	20.00	25	18.10
4	38	24.50	59	22.30	6	30.00	0	0.00	9	13.40	139	20.90	102	20.40	2	13.30	0	0.00	22	15.90
5	43	27.70	78	29.40	2	10.00	0	0.00	19	28.40	172	25.80	129	25.70	2	13.30	3	30.00	29	21.00
6	51	32.90	88	33.20	8	40.00	1	100.00	19	28.40	135	20.30	107	21.40	5	33.30	3	30.00	16	11.60

Table 2 The three most frequent developmental domain risks for children in using touch screen devices as identified by parents/caregivers

Developmental domains	Risks	Percent (%)
Physical	Vision deterioration	69.1
	Inactive lifestyle	9
	Radiation	5.1
Intellectual	Addiction	55.4
	Undesirable contents	13.6
	Over-dependence	8.8
Emotion	Poor social-emotional development	21.3
	Encouragement of instant gratification	
	Throw tantrums	18.7
	Impatience	17.3
Social	Poor social competence	27.1
	Social withdrawal	24.4
	Poor communication skills	8.8

Question 4: What are Parents'/Caregivers' Views of Benefits of Their Children Accessing Touch Screen Devices?

A total of 1,265 qualitative responses were collected from parents/caregivers in regards to their views on perceived benefits of their children accessing the emerging touch screen devices. The majority of parents/caregivers (n = 759, 60 %) expressed that touch screen devices may benefit children's intellectual development. Table 3 summarises the three most frequent benefits in each developmental domain as identified by parents/caregivers.

Summary and Discussion of the Findings

Smartphone and Touch Screen Devices are Commonly Used by Children in Singapore

The fact that smartphone and touch screen tablet were the most popular technological devices used by children aged under 7 years in Singapore is not surprising. These are very accessible devices and are in constant use by adults (Networks Asia 2013), and therefore, available when parents "hand them over" to children for whatever reason: something to keep a restless toddler occupied when shopping or travelling by some form of transport in Singapore. It can be, as expressed by Jakubek (2012), the ultimate babysitter.

Most Children Used Smartphone and Touch Screen Devices Daily

The data show that 7-year-olds in Singapore used technological devices less than 1 h per day. Except for infants (aged under 1 year), children under the age of seven years used smartphones and touch screen tablets daily. Other summary points were that 3-year-olds spent the largest amount of time on smartphones; on average, 6 h per day. Five-year-olds spent the largest amount of time on touch screen devices (0.6 h daily). Desktop and laptop computers were used mainly by 6-year-olds. Whilst this amount of time may not seem alarming as it meets with some western guidelines (Raising Children Network 2012), parents may still need to be aware of researchers' consistent comments on the rapid pace of the penetration of digital technology into younger age groups (Bassiouni and Hackley 2014; Leggett 2013).

The Use of Touch Screen Devices May Impact on Children's Intellectual and Physical Development

The findings show that touch screen devices were widely accessed by young children in Singapore, but a large proportion of parents (55 %) expressed concern that such devices were most risky for their children's intellectual development. Parents were particularly worried about addiction. Such a finding is consistent with some previous research on internet addiction (Griffiths 1997; Nalwa and Anand 2003; Young 1996) and also with a recent newspaper report in Australia (Lunn 2012). Instead of installing compulsory anti-addition software into the digital devices (Straker et al. 2009, p. 1392), parents are encouraged to ensure their children are taught moderation and self-regulation. Also, parents need to supervise children to achieve a balance in lives with activities beyond touch screen.

Parents' concerns are about the physical risk is also confirmed with the comments earlier in the paper that physiotherapists are treating very young children for conditions that could be associated with overuse, that is, bending over screens, being in awkward, unhealthy positions when using smart phones and other electronic touch screen items. Surr (2012) concludes that young children's

Table 3 The three most frequent developmental domain benefits for children in using touch screen devices as identified by parents/caregivers

Developmental domains	Benefits	Percent (%)
Physical	Enhances motor skills	61.5
	Improves psychomotor skills	26.9
	Improves sensory skills	3.8
	Improves reflexes	
Intellectual	Improves academic outcomes	35.4
	Creative and interactive learning	14.8
	Enhances learning process	14.1
Emotional	Captures interest	80
	Nurtures appreciation for music and aesthetics	6.3
	Encourages independence	5
	Reduces tantrums	
Social	Promotes technology awareness	48.6
	Easily accessible and portable	17.5
	Entertaining	11.2

intense involvement in screen media has adverse effects on their growth and physical health. He further states that professionals in early education and care have a responsibility, in the best interests of the children, to wean them from excessive dependence on screen media. The American Academy of Pediatrics (2011) also warns that technology plays an important role in the current epidemic of childhood and adolescent obesity.

The Use of Touch Screen Devices May Benefit Children's Physical and Intellectual Development

Singaporean parents' views on intellectual development are indeed similar to some recent studies in the western context (Neumann and Neumann 2014). Such a view that touch screen devices benefit children may due to the huge number of apps for touch screen devices which are labelled as 'educational'. Researchers (Guernsey and Levine 2015) remind parents and educators to rethink the key features of those educational apps and the children's learning needs. These may not be educational but games oriented.

Implications for Parents and Teachers

Although the amount of time given over to usage of technological devices by young children, as reported by their Singaporean parents/caregivers, was not excessive, there are some implications for parents, caregivers and teachers to consider about the use of technological devices.

Children in the age groups presented in the study (i.e., aged under 7 years) need opportunities to develop their gross motor skills to compensate for the use of 'touch screens'. For children who are mobile, this opportunity should include outdoor play (e.g., running and climbing) to develop and coordinate different physical skills. Concern has been expressed that use of screen media displaces other physical activity (The American Academy of Pediatrics 2011). This source also reports that some children spend more time with media than any other activity except for sleeping, more than 7 h a day, and that children under the age of 2 years should not have any screen exposure. Steyer (2012) reinforces this point that watching any screen media has no value for infants and toddlers 2 years of age and under. They learn by interacting with real people, objects and by experimenting. The use of touch screen does not involve opportunities for sensory learning beyond the tactile.

In summary, the following points emerged from the research:

- The concern reported in the media that children need physiotherapy at very early ages is alarming.
- Usage of technological devices is most likely to increase, not decrease, as children grow. The marketing of games, toys, devices with the emerging touch screen devices is pervasive.
- Parents need to consciously limit the amount of time young children spend on technological gadgets, especially touch screen devices. Children under the age of two should not access any touch screen devices. The statements by The American Academy of Pediatrics (2011) and NAEYC (2012) in relation to this point need to be taken seriously.
- The concern reported by parents/caregivers in relation to addiction is an important one. It is important for parents to realise that a technological device is not a toy, but is an adult's tool.
- Sedentary activities may affect the physical fitness of a child. That is, lack of physical activity can lead to obesity or overweight children (Hills, Andersen and Byrnes 2011).

- Dynamic systems theory (Thelen and Smith 1994) shows that all development, including physical, is interlinked, including neurological. Children need opportunities that challenge their physical level, that is, some safe risk-taking activities—climbing for example. Such activities usually occur in authentic play environments.
- Learning via touch screen relies on visual input to the brain. Infants, toddlers and young children need sensory activities as they are not at a level of abstract thinking where they can benefit from screen usage. They need direct, first-hand experience with materials and equipment that challenge their thinking and problem solving skills. Touch screen usage will not facilitate these in infant and toddler development.
- There is no substitute for direct interaction with parents, carers and the first hand manipulation of concrete materials.

Conclusion

Children are growing up into a digital age and their skills and knowledge are likely to outstrip the knowledge of their parents. However, their technological abilities are often ahead of their emotional maturity and judgement (Steyer 2012). We cannot insulate children from technology, but we need to ensure that they are not harmed in any way by it. Many of the studies reviewed for this research point to the need for parents/caregivers to supervise children's access and time spent on technology. The American Academy of Pediatrics (2011) states that children spend more time with technology than in any other activity except for sleeping—an average of more than 7 h per day. They cite studies that have found physical activity decreases as screen time increases. The media are known to disturb children's sleep patterns. The website of the NAEYC (2012, p. 5) also states that:

> For infants and toddlers, responsive interactions between adults and children are essential to early brain development and to cognitive, social, emotional, physical, and linguistic development

This message is timely for parents, caregivers and teachers who may need to be reminded how vulnerable young children are to environmental influences including technology.

The study is unique as there is little research data in Singapore, a technologically advanced society, about access, time spent and usage of touch screen devices with young children under the age of 7 years. It is hoped that the findings of this study will play some part, however small, in raising parents'/caregivers' awareness of access to technological devices. Children deserve a childhood that offers opportunity for facilitating their development, monitoring technological usage will enable this to happen.

References

American Academy of Pediatrics. (2011). Policy statement: Children, adolescents, obesity, and the media. *Pediatrics, 128*(1), 201–208. Retrieved November 01, 2014, from http://pediatrics.aappublications.org/content/128/1/201.full.pdf

Appel, A. E., & O'Gara, C. (2001). Technology and young children: A review of literature. *TechKnowLogia, 3*(5), 35–36. Retrieved February 6, 2015, from http://www.techknowlogia.org/TKL_Articles/PDF/321.pdf

Armstrong, A., & Casement, C. (2000). *The child and the machine. How computers put children's education at risk*. Beltsville, MD: Robins Lane Press.

Bassiouni, D. H., & Hackley, C. (2014). 'Generation Z' children's adaptation to digital consumer culture: A critical literature review. *Journal of Customer Behaviour, 13*(2), 113–133. Retrieved November 02, 2014, from http://www.academia.edu/8727511/_Generation_Z_Children_s_Adaptation_to_Digital_Consumer_Culture_A_Critical_Literature_Review

Berger, K. S. (2008). *The developing person through childhood and adolescence* (8th ed.). New York, NY: Worth.

Bilbao-Osorio, B., Dutta, S., & Lanvin, B. (Eds.). (2014). *The global information technology report 2014: Rewards and risks of big data.* Retrieved October 10, 2014, from http://www3.weforum.org/docs/WEF_GlobalInformationTechnology_Report_2014.pdf

Bredekamp, S. (2011). *Effective practices in early childhood education: Building a foundation*. Upper Saddle River, NJ: Pearson.

Brooks-Gunn, J., & Donahue, E. H. (2008). Introducing the issue. *The Future of Children, 18*(1), 3–10. Retrieved February 6, 2015, from http://www.princeton.edu/futureofchildren/publications/docs/18_01_01.pdf

Char, C. A. (1990). *Interactive technology and the young child.* Retrieved November 01, 2014, from http://www2.edc.org/ncip/library/ec/char.htm

Clarke, A. M. (2006). *ETSI white paper no 2. Young children and ICT: Current issues in provision of ICT technologies and services for young children*. Retrieved July 01, 2012, from http://www.etsi.org/WebSite/document/Technologies/ETSI-WP2_Children_ICT.pdf

Clements, D. H., Nastasi, B. K., & Swaminathan, S. (1993). Young children and computers: Crossroads and directions from research. *Young Children*, *48*(2), 56–64. Retrieved November 02, 2014, from http://www.researchgate.net/publication/234586711_Young_Children_and_Computers_Crossroads_and_Directions_from_Research._Research_in_Review

Cordes, C., & Miller, E. (Eds.). (2000). *Fool's gold: A critical look at computers in childhood*. Retrieved February 6, 2015, from http://drupal6.allianceforchildhood.org/fools_gold

D'Agostino, D., Farhan, H., & Worthington, H. (2012). *Web Index 2012*. Retrieved September 03, 2014, from http://www.sirc.ntu.edu.sg/Events/Documents/2012-Web-Index-Key-Findings.pdf

Department of Education, Employment and Workplace Relations. (2009). *Belonging, being and becoming: The early years learning framework for Australia*. Retrieved November 02, 2014, from https://www.coag.gov.au/sites/default/files/early_years_learning_framework.pdf

Fatouros, C. (1995). Young children using computers: Planning appropriate learning experiences. *Australian Journal of Early*

Childhood, *20*(2), 1–6. Retrieved from ERIC database. ERIC number: EJ513990.

Follari, L. M. (2010). *Foundations and best practices in early childhood education: History, theories, and approaches to learning* (2nd ed.). Upper Saddle River, NJ: Pearson.

Gorra, A., Finaly, J., Devlin, M., Lavery, J., Neagle, R., Ross, J., et al. (2010). *Learning with technology: What do students want?* Paper presented at the 5th international conference on elearning, Penang, Malaysia. Retrieved from http://tums.ac.ir/1392/10/01/icel10-cd2.pdf-zolfaghm-2013-12-22-02-35.pdf

Griffiths, M. (1997). Psychology of computer use: XLIII. Some comments on 'Addictive use of the internet' by young. *Psychological Reports, 80*(1), 81–82.

Guernsey, L., & Levine, M. H. (2015). Pioneering literacy in the digital age. In C. Donohue (Ed.), *Technology and digital media in the early years: Tools for teaching and learning* (pp. 104–114). New York: Routledge and NAEYC.

Haugland, S.W. (2000). Early childhood classrooms in the 21st century: Using computers to maximise learning. *Young Children*, *55*(1), 12–18. Retrieved from http://ammonwiemers.com/IdetPortfolio/articles/Technology%20Integration/Early%20Childhood%20Classrooms%20in%20the%2021st%20Century%20–%20Using%20Computers%20to%20Maximize%20Learning.pdf

Healy, J. M. (1998). *Failure to connect: How computers affect our children's minds—for better and worse*. Retrieved from http://www.sfu.ca/educ260/Healy%208.pdf

Highfield, K. (2010). Possibilities and pitfalls of techno-toys and digital play in mathematics learning. In M. Ebbeck & M. Waniganayake (Eds.), *Play in early childhood education: Learning in diverse contexts* (pp. 177–196). South Melbourne, VIC: Oxford University Press.

Hills, A. P., Andersen, L. B., & Byrne, N. M. (2011). Physical activity and obesity in children. *British Journal of Sports Medicine, 45*, 866–870. doi:10.1136/bjsports-2011-090199.

Infocomm Development Authority of Singapore. (2013). *Annual survey on infocomm usage in households and by individuals for 2012*. Retrieved October 10, 2014, from http://www.ida.gov.sg/~/media/Files/Infocomm%20Landscape/Facts%20and%20Figures/SurveyReport/2012/2012HHmgt.pdf

Jakubek, A.M. (2012). The ultimate babysitter? iPads for infants stir debate. *Agence France-Presse*. Retrieved from https://sg.news.yahoo.com/ultimate-babysitter-ipads-infants-stir-debate-061240472.html

Johnson, B., & Christensen, L. (2012). *Educational research: Quantitative, qualitative, and mixed approaches* (4th ed.). Thousand Oaks, CA: Sage.

Kumar, R. (2011). *Research methodology: A step-by-step guide for beginners* (3rd ed.). London: Sage.

Lee, S.-J., Bartolic, S., & Vandewater, E. A. (2009). Predicting children's media use in the USA: Differences in cross-sectional and longitudinal analysis. *British Journal of Developmental Psychology, 27*(1), 123–143. doi:10.1348/026151008X401336

Leggett, S. (2013). *Children and their media 2013: The complex media interactions of children aged 5 to 16*. Retrieved October 12, 2014, from http://prezi.com/6spkttfivlhp/children-and-their-media-2013/

Levin, D. E. (2011). *Beyond remote-controlled teaching and learning: The special challenges of helping children construct knowledge today*. Retrieved from http://www.commercialfreechildhood.org/sites/default/files/levin_RCCteachinglearning.pdf

Levin, D. E. (2013). *Moving beyond remote-controlled teaching and learning*. [Diane E. Levin's Blog on Raising Healthy Kids in a Mad World]. Retrieved from http://dianeelevin.com/2013/moving-beyond-remote-controlled-teaching-and-learning/

Lunn, S. (2012). Toddlers, touch screens and the parents' dilemma. *The Australian*. Retrieved April 27, 2013, from http://www.theaustralian.com.au/news/features/toddlers-touch-screens-and-the-parents-dilemma/story-e6frg6z6-1226238471750

Meegan, G. (2013). Need a bad back, kids? There's an app for that. *Sunday Mail State Edition*, p. 5.

Mioduser, D., Tur-Kaspa, H., & Leitner, I. (2000). The learning value of computer-based instruction of early reading skills. *Journal of Computer Assisted Learning*, *16*, 54–63. Retrieved from http://muse.tau.ac.il/publications/66.pdf

Nalwa, K., & Anand, A. P. (2003). Internet addiction in students: A cause of concern. *CyberPsychology and Behaviour, 6*(6), 653–656. doi:10.1089/109493103322725441.

National Association for the Education of Young Children. (2012). *Technology and interactive media as tools in early childhood programs serving children from birth through age 8*. Retrieved July 10, 2012, from http://www.naeyc.org/files/naeyc/PS_technology_WEB.pdf

Networks Asia. (2013). *Singapore smartphone and tablet penetration on the rise; app usage increasing*. Retrieved October 02, 2014, from http://www.networksasia.net/article/singapore-smartphone-and-tablet-penetration-rise-app-usage-increasing-1371518626

Neumann, M. M., & Neumann, D. L. (2014). Touch screen tablets and emergent literacy. *Early Childhood Education Journal, 42*(4), 231–239. doi:10.1007/s10643-013-0608-3.

Raising Children Network. (2012). *Screen time and children*. Retrieved September, 07, 2014, from http://raisingchildren.net.au/articles/screen_time.html/context/1112

Roe, K., & Muijs, D. (1998). Children and computer games: A profile of the heavy user. *European Journal of Communication, 13*(2), 181–200. doi:10.1177/0267323198013002002.

Steyer, J. P. (2012). Kids' media use needs parent guidance. *Work and Family Life, 26*(9), 1–8. Retrieved from http://www.ag.ndsu.edu/professionaldevelopment/hidden/september-2012

Straker, L., Pollock, C., & Maslen, B. (2009). Principles for the wise use of computers by children. *Ergonomics, 52*(11), 1386–1401. Retrieved from http://www.iea.cc/ECEE/pdfs/strakerprinciplesErgo2009.pdf

Surr, J. (2012). *Too many channels? Sifting through the recommendations on screen media and technology*. Retrieved April 27, 2013, from https://ccie-media.s3.amazonaws.com/downloads/screenmediaadvice.pdf

Swaminathan, S., & Wright, J. L. (2003). Educational technology in the early and primary years. In J. P. Isenberg & M. R. Jalongo (Eds.), *Major trends and issues in early childhood education* (2nd ed., pp. 136–149). New York, NY: Teachers College Press.

Teng, A. (2013). Kids 'using gadgets at earlier age being exposed to risks': Study. *The Straits Times*. Retrieved October 10, 2014, from http://www.straitstimes.com/breaking-news/singapore/story/kids-using-gadgets-earlier-age-being-exposed-risks-study-20130605

Thelen, E., & Smith, L. B. (1994). *A dynamic systems approach to the development of cognition and action*. Cambridge: MIT Press.

Vandewater, E. A., Rideout, V. J., Wartella, E. A., Huang, X., Lee, J. H., & Shim, M. (2007). Digital childhood: Electronic media and technology use among infants, toddlers, and preschoolers. *Pediatrics, 119*(5), e1006–e1015. doi:10.1542/peds.2006-1804

Wyness, M. (2006). *Childhood and society: An introduction to sociology of childhood*. Basingstoke: Palgrave Macmillan.

Yelland, N. J. (1999). Reconceptualising schooling with technology for the 21st century: Images and reflections. In D. D. Shade (Ed.) *Information technology in childhood education annual* (pp. 39–59). Retrieved from ERIC database. EJ595776

Young, K. S. (1996). Psychology of computer use: XL. Addictive use of the internet: A case that breaks the stereotype. *Psychological Reports, 79*(3), 899–902. Retrieved from http://www.netaddiction.com/articles/stereotype.pdf

Zickuhr, K. (2011). *Generations and their gadgets*. Retrieved October 01, 2014, from http://www.pewinternet.org/files/old-media/Files/Reports/2011/PIP_Generations_and_Gadgets.pdf