



RESEARCH AND EVALUATION OF SCREEN TIME AND DIGITAL TECHNOLOGY

A report prepared by staff from the Babylab at Swinburne University of Technology

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ACKNOWLEDGEMENTS

The authors would like to thank Swinburne Babylab members Ms Dorothea Martin, Ms Paola Araiza, Ms Brittany Huber and Ms Emily Piper for their assistance with data gathering. The authors would also like to thank key stakeholders for their participation in interviews, and Kim Woodland Editing for editing and proofreading.

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PUBLICATION DETAILS

Prepared by Swinburne University of Technology for the Australian Government Department of Education and Training.

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Disclaimer

The views expressed in this report are solely the authors and do not necessarily reflect the views of the Swinburne University of Technology, the Australian Government, or people consulted during the research project.

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Suggested citation

Kaufman, J., Highfield, K., Guy, J., Leung, S., & Wallis, K. (2017). *Research and evaluation of screen time and digital technology: Report to the Australian Government Department of Education and Training*. Melbourne, Australia: Swinburne University of Technology.

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Executive Summary

The study presented in this report reviewed current policy, guidelines and recommendations about digital technology use in educational and other contexts. The research team further assessed the extent to which these policies and guidelines have a strong evidence base. This assessment was based on the research team's own review of the scientific literature as well as on interviews with key stakeholders working in the field of children and technology. This review is presented in several stages.

Key findings from systematic review of literature

A systematic review of the literature identified 653 relevant peer-reviewed articles. Findings reported were largely positive for the impacts of technology on learning/educational outcomes. With respect to health/physical outcomes, the results were more mixed and were directly addressed by few papers.

Learning/educational

The majority of papers in the systematic review examined the impact of technology use on a learning or educational outcome. Most of these reported positive findings (75%) and were focused on various key learning areas including literacy, mathematics and science.

Health/physical

There is relatively little research into the impacts of technology use on health and physical outcomes. Most research is characterised by "screen time" studies examining time spent using various technologies and their links to health outcomes (correlations), or studies examining the effectiveness of "exergames" (active video games). Positive health/physical outcomes were largely reported from exergame studies, whereas negative health outcomes were reported through studies linking excessive screen use with factors such as musculoskeletal disorders, headaches, obesity and poor sleep.

Key findings from analysis of guidelines

A total of 54 separate guidelines and policy statements were collected from Australian and international sources. Most of the guidelines analysed through this study were published between 2015–2017, with a limited number published between 2007–2014. The guidelines focus predominantly on Organisation for Economic Co-operation and Development (OECD) nations.

Analysis of guidelines and policy statements is focused on four levels: national guidelines, regional guidelines (such as states or municipalities), not-for-profit organisations and peak bodies (e.g., the American Academy of Pediatricians and the Australian Optometrists Association), and school and preschool guidelines as suggested at an organisational or systemic level.

Key findings from qualitative analysis of stakeholders

Qualitative analysis of data collected from 17 interviews with key stakeholders and senior researchers in the field of children and technology established a range of positions on the use of digital technologies in education contexts. These included positive support for their use in enhancing learning outcomes, as well as caution in integrating technology, particularly with very young children.

The majority of organisations approached did not have a formal position on technology use in educational contexts. Official and unofficial positions were informed in various ways including conducting their own research (e.g., through national surveys), philosophies of education and reference to published empirical research. Particular information sources mentioned included multiple individual researchers and experts, Australian Government authorities and peak bodies, and American authorities and peak bodies. Several interviewees expressed concern with a "gap" in guidelines for prior-to-school and out-of-school-hours educational use of technology.

Introduction

Digital technology is nearly ubiquitous in Australian society and in developed nations throughout the world. The user base of digital technology is no longer confined to people working in specific industries or to any single demographic. People, across the developmental spectrum, use digital media in work, education, entertainment, socialisation and home management on a daily basis. The digital landscape extends into school and preschool settings, as educators strive to take advantage of digital media as a learning tool.

While digital technologies provide many new learning opportunities, they also present possible risks. Research shows that excessive media consumption is associated with sedentary behaviour patterns which can have long-lasting effects on health. There is also considerable debate about how “screen time” may affect children’s cognitive and brain development.

Because screen use by children in educational settings must be evaluated separately from screen use generally, it is important to establish what the current research indicates about digital technology use in educational settings. For example, it is important to know: How and under what circumstances do digital technologies in preschool and school settings promote or interfere with learning? How does its use potentially influence physical and emotional development? How does it influence child behaviour during and outside of school hours? Importantly, how has this research influenced current policy, guidelines and recommendations by government bodies and other key agencies in developed countries?

In the study presented in this report, we reviewed current policy, guidelines and recommendations about digital technology in the educational context. We further assessed the extent to which these policies and guidelines have a strong evidence base. This assessment was based on our own rigorous study of the scientific literature as well as on interviews with key stakeholders and senior researchers in the field of children and technology.

The primary and secondary research questions that we aimed to answer were:

Research questions

Primary research questions

- 1) What is the current range of research in this area, and what are the key issues that have been highlighted in the research?
- 2) What are the factors which have the greatest influence on the exposure of children to screen time in educational settings?
- 3) What is the impact of the use of digital technologies on children’s health and development outcomes in an educational setting?
- 4) What is the interaction between screen time use for education and entertainment?
- 5) What are the most effective types of digital technologies for improving learning outcomes?
- 6) What is the current range of guidelines on screen time and the use of digital technologies in an education setting and how do they respond to research in the area?
- 7) Is there any evidence that current guidelines have been successful in influencing the use of digital technologies of children in educational settings?
- 8) Is there a model of “best practice” in the use of digital technologies in preschool, primary school and high school regarding which risks of using digital technologies can be ameliorated and positive outcomes maximised? What are the most effective pedagogies for incorporating digital technologies into an educational setting?

Secondary research questions

- 1) Is there a need for national guidelines on the amount of time children use digital technologies in educational settings? If not, what are the reasons?
- 2) If so, what should these guidelines include and why?
- 3) Could a screen time limit practically apply to different types of digital media, e.g., interactive versus passive? Would these guidelines change for different educational settings or age groups and why?
- 4) What is the interaction between time spent on educational purposes and entertainment – should there be separate limits in addition to total limits?
- 5) If a screen time limit isn't practical, what other ways can educators reduce the risks associated with the use of digital technologies by children and maximise learning outcomes and wellbeing?

In our study, we aimed to answer these questions in four concurrent stages.

Stage 1

Stage 1 reviewed the current research literature on children and technology, which included a systematic review focusing on children's health/physical development and learning/education. This review explored themes and contradictions arising from the research.

Stages 2 and 3

Stage 2 was an examination of current guidelines at local, national and international levels. The guidelines focus predominantly on Organisation for Economic Co-operation and Development (OECD) nations. Analysis of guidelines is focused on four levels: national guidelines, regional guidelines (such as states or municipalities), not-for-profit organisations and peak bodies (e.g., the American Academy of Pediatricians and the Australian Optometrists Association), and school and preschool guidelines as suggested at an organisational or systemic level. Stage 3 was an analysis of current guidelines and their alignment to research. This analysis examined and tabulated alignment to key themes arising from research.

Stage 4

Stage 4 was a qualitative analysis of key stakeholders, including researchers, peak bodies and educational contexts, to explore their current perceptions and processes. Using semi-structured interviews, the research team identified key issues and recommendations and examined the perspectives of stakeholders such as peak educational bodies.

These stages are further outlined and our results are presented below.

Results

Stage 1

Stage 1 of this study consisted of reviewing the literature related to children's exposure to new technology. The presentation of results in this stage is divided into multiple sections. While the main focus of the review was on children and new technology, this must be understood in the context of decades of prior work which has examined traditional media effects (i.e., largely television exposure). Consequently, the first section (Section 1) consists of a general review of this existing literature. The next section (Section 2) consists of a systematic review of the literature on the health and physical effects of children's use of new technology. The third section (Section 3) consists of a systematic review of the literature on learning and educational outcomes as a function of children's new technology use. The fourth and final section of Stage 1 (Section 4) consists of a systematic review of the literature on teachers' use of new technology in the classroom.

Method

In relation to Section 1, numerous research studies have been conducted on the effects of television on children's learning and development. Rather than review each of these papers here, we focused on published literature reviews on this topic. To identify relevant recent reviews, we searched the Web of Science from 2007–2017 for papers that included the keywords: "children or adolescents and television"; and one of the following words: "development, learning, social, health, emotional, diet, cognitive"; and "review", anywhere in a paper's abstract, title or keywords. This search resulted in 255 papers. A manual search of the bibliographies of the most recent papers revealed three additional relevant papers for a total of 258. Important themes related to the effects of television on children in various categories (including physical health, social-emotional and mental health and cognitive ability) were then drawn from these 258 papers, and are presented below.

For Sections 2, 3 and 4, our search strategy was based on our primary goal to provide information on how children's technology use relates to multiple distinct areas including children's health and physical development and children's learning and education. A secondary goal was to assess factors that facilitate the use of new technology in the educational context.

To achieve our primary goals, our search strategy involved identification of papers that met the following key criteria:

- 1) The study must involve children
- 2) The study must focus on children's use of new technology
- 3) The study must examine a factor related to
 - a) Health and/or physical development
 - b) Learning, cognitive functioning and/or educational outcomes.

To achieve this, in July 2017 we searched two databases (SCOPUS and Web of Science) with searches that aimed to meet the three criteria above. Specifically, each paper needed to include at least one term from each column in **Table 1** below. The terms from the Child Related and Outcome Related columns were searched for anywhere within a paper's abstract, title or keywords. The terms from the Technology Related column were required to be in either the title or as a keyword. The requirement to be included as a title word or keyword was based on preliminary searches that included a very large number of unrelated papers that focused on computers or other devices used in data collection or data analysis. Note that we also included variants of the terms listed in **Table 1** (e.g., by including the appropriate wildcards or adding word variants). The terms listed include only a single variant for the sake of readability.

After removing duplicate records from both database searches, there were a total of 1,500 results. From these we eliminated studies from our analysis for the following reasons:

- 1) They were not peer-reviewed journal articles (i.e., conference proceedings or published abstracts).
- 2) They were described as research that was intended to be a "pilot", "preliminary study" or "proof of concept".
- 3) They did not address any of our key research questions.

For papers relating to child health/physical or learning/educational outcomes we also removed papers that described "case studies". Case studies were retained, however, for studies that focused on factors that facilitate the use of technology in the classroom.

For papers relating to learning/educational outcomes we also removed those that examined digital literacy. This was because studies focusing on digital literacy do not provide information about the health or educational outcomes of technology use.

Table 1: Search terms for systematic review (Sections 2, 3 and 4)

Child related terms	Technology related terms	Outcome related terms
adolescent	android	body mass
child	App	brain or neuronal
infant	augmented reality	health
pupil	blended classroom	heart rate
student	computer	motor
teenager	digital	musculoskeletal
toddler	ebook	physical
	e-learning	physiological
	exergame	posture
	flipped classroom	sedentary
	game-based	weight
	gamification	obesity
	iPad	-----
	mobile device	achievement
	multimedia	cognitive
	online game	education
	social media	executive control
	technology	executive functioning
	touchscreen	learn
	virtual reality	memory
	web-based	problem solving

Following this process, we were left with a total of 653 relevant papers, which included: 95 papers that examined technology use and health, 415 papers that examined technology and learning education (with 7 of these papers examining both health and learning), and 150 that related to factors that influence teachers’ use of technology in their pedagogy.

Papers that assessed a health/physical development outcome were coded for the following:

- 1) What was the predominant effect of technology on children’s health/physical development?
 - a) A code of “positive” was used where the technology usage was reported as having a predominantly positive effect on a health or physical outcome.
 - b) A code of “negative” was used where the technology usage was reported as having a predominantly negative effect on a health or physical outcome.
 - c) A code of “no effect” was used where technology usage was not found to have any effects on health/physical development.
 - d) A code of “mixed” was defined as having a combination of (a), (b) and (c) above; or reported effects that were specific to a subset of the sample (e.g., if different effects were reported for different genders or age groups).
- 2) What aspect of health/physical development was assessed? Key options were: physical health, body mass index (BMI), diet, sleep, musculoskeletal (e.g., posture, physical growth) and physiological (e.g., heart rate, blood pressure) measures).

- 3) What was the predominant effect of technology on children’s learning/education or cognitive development?
- 4) A code of “positive” was used where children were reported to have learnt from the technology usage. If a non-technology control was used in the study, “positive” meant that such learning must be reported as exceeding learning from the non-technology control.
- 5) A code of “negative” was used where children were reported to not have learnt from technology usage. This code would also be used if children were reported to have learnt less than those in a non-technology control condition.
- 6) A code of “no effect” was used where children’s learning from technology did not differ from traditional teaching.
- 7) A code of “mixed” was defined as having a combination of (a), (b) and (c) above; or reported effects that were specific to a subset of the sample (e.g., if different effects were reported for different genders or age groups).
- 8) What aspect of learning/educational/cognitive development was assessed? Key options included: learning/engagement with specific learning material, broader measures of learning and measures of cognitive performance (e.g., attention, memory, creativity, executive function).

We also coded for the main context in which children were exposed to technology. Key options were: home, school (including preschool), and other (e.g., museum, research lab, after school program). For the health and physical context, we also included an option: anywhere (e.g., studies that did not specify a setting, or screen time studies that measured total technology usage duration without indicating a specific context). Finally, papers were also coded for the type of technology used by the children, whether the digital interaction was performed alone or with others, and whether the digital experience was interactive or passive.

Section 1: General review of television and young children

Physical health

According to a recent review (Domingues-Montanari, 2017), higher television viewing (but not computer use and video gaming) was associated with lower physical strength, irrespective of physical activity. It also highlighted the idea that not all types of screen use are equal with respect to health effects. For instance, headaches were more frequent during television viewing for more than three hours per day, whereas backache and headache were more likely during computer use or video gaming for more than three hours per day.

Tremblay et al. (2012) conducted a systematic review on sedentary behaviour in school-aged children and youth. They found watching television for more than two hours per day was associated with reduced physical health, including unfavourable body composition (overweight/obesity) and decreased fitness. In Tremblay et al.’s (2012) review of toddlers and preschoolers they reported that increased television viewing was associated with unfavourable measures of adiposity.

According to a recent meta-analysis (Zhang et al., 2016) revealed a dose-response relationship between childhood obesity and television watching; specifically, a 13% increase in risk of obesity was associated with every one hour per day increment of television watching. A systematic review by Avery, Anderson, and McCullough (2017) suggested that for children, from preschool age onwards, eating whilst watching television reduces diet quality with more high-fat, high-sugar foods, fewer fruits and vegetables and increased consumption of sugar-sweetened beverages. The review by Domingues-Mongtanari (2017) concluded that the link between television viewing and poor diet was strongest for those children who watched the most commercial television and those who were exposed to advertisements embedded within programs.

Social-emotional and mental health

According to Domingues-Mongtanari (2017), high levels of television viewing is an independent risk factor for reduced psychological wellbeing, such as increased risk of peer victimisation during early school years. Kappos's (2007) review pointed out that television viewing was associated with issues such as anxiety, depression, irregular sleep, attention deficits and suicidal rates. In contrast, one systematic review concluded from the literature focused on children and young people with behavioural and emotional difficulties, that there was insufficient, contradictory and methodologically flawed evidence on the association between television viewing/video game playing and aggression in these cohorts (Mitrofan & Spencer, 2009).

It should be noted that most television reviews did not take into account the content consumed by children on television. As pointed out by the Australian Council for Educational Research (ACER) review (2010), educational television programs can help improve children's school readiness by building not only their literacy and numeracy skills, but also their cultural awareness, self-esteem and understanding of school-appropriate behaviours. Such educational benefits can last into secondary school. Specifically, the ACER review pointed out that educational television programs aimed primarily at Indigenous preschool children are an important vehicle for raising awareness around language and cultural identity (ACER, 2010).

Cognitive ability

Domingues-Mongtanari (2017) highlighted that children with 2–3 hours daily of television viewing had a higher risk of language delay than those with less than one hour of daily viewing. Indeed, an earlier review by Moses (2008) also pointed out that more than a moderate amount of television (more than 3–4 hours) related to more negative outcomes, such as less time spent reading and lower reading achievement. In addition, some authors (ACER, 2010; Domingues-Mongtanari, 2017) highlighted that adult co-viewers who offer comments and interpretations of content could improve the amount that children learn from educational programs; hence enriching a child's experience.

Conclusion

In conclusion, the effect of television on young children's development are: 1) a large amount of television viewing has a negative influence on young children, in all categories: physical/health, social-emotional and mental health or cognitive ability; and 2) learning from educational television may be more likely to occur when the program is viewed with an adult co-viewer who engages the child in the learning material.

Section 2: Systematic literature review of health and physical outcomes of new technology use

Literature characteristics

There were altogether 95 relevant papers in the areas of health and physical outcomes of new technology use. The following section contains the characteristics of these papers, in terms of context (where the technology device was used), device (what kind of device was used) and age.

As indicated in **Table 2**, most examinations of technology use were applicable to multiple contexts (e.g., school and home); while fewer focused specifically on the use of technology in the home, school or other context. Some of these were focused on the impact that "exergames" (physically active video games) can have on health and physical outcomes such as activity levels, weight or other health indicators such as heart rate and blood pressure. Others examined the link between general media and technology use on health and physical outcomes such as weight, activity levels, sleep quality or

wellbeing. A small number focused on the impact of technology use on posture, bone mass and musculoskeletal pain.

Table 2: Context

Context	Number of papers	Percentage (%)
Anywhere	58	61
School	17	18
Home	14	15
Other	6	6
Total	95	100

As **Table 3** shows, the majority of studies examined either multiple or tablet/mobile touchscreen technology. Game consoles, including exergaming, were also included in a number of studies. Fewer studies focused on computer or other media (including television) use specifically. This could be due to a number of factors such as the search terms being used more frequently for newer technologies, and also the period of the review (2007–2017) coinciding with the proliferation of touchscreen technologies.

Table 3: Device type

Device type	Number of papers	Percentage (%)
Multiple	31	33
Game console	24	25
Tablet/Phone (touchscreen)	21	22
Computer	7	7
Other	5	5
Virtual/Augmented reality	4	4
Television/Video	3	3
Total	95	100

Note: Parent and teacher papers were removed from this analysis, as the focus of this section was studies examining children’s outcomes.

As can be seen in **Table 4**, in relation to health and physical outcomes, the majority of studies focused on the primary and secondary age cohorts (5–18 years). Fewer examined preschool age (2–4 years) and infancy (under 2) or parents or teachers. If a study focused on participants in the middle school setting, we ascertained the age of the participants and categorised them as either primary school or high school depending on which school type they would be attending if within the Australian school system.

Table 4: Age

Age group	Number of papers	Percentage (%)
Secondary school (13–18 years)	43	45
Primary school (5–12 years)	41	43
Mixed	6	6
Preschool (<5 years)	5	5
Total	95	100

Table 5 details the context break down in the different age groups for studies focusing on health and physical outcomes related to technology use.

Table 5: Context as a function of age group

Age group	Anywhere	Home	Other	School	Total
Secondary school (13–18 years)	30 (70%)	7 (16%)	1 (2%)	5 (12%)	43 (100%)
Primary school (5–12 years)	18 (44%)	7 (17%)	4 (10%)	12 (29%)	41 (100%)
Mixed	5 (83%)	0 (0%)	1 (17%)	0 (0%)	6 (100%)
Preschool (<5 years)	5 (100%)	0 (0%)	0 (0%)	0 (0%)	5 (100%)
Total	58 (61%)	14 (15%)	6 (6%)	17 (18%)	95 (100%)

Results

As indicated in **Table 6**, the majority of studies reported positive findings on health and physical outcomes of technology use. An approximately equal number found negative or mixed outcomes, with a small number reporting no effects. Many of the studies that reported positive outcomes on health examined the effects of exergames. For example, several studies found that exergaming can increase physical activity and energy expenditure (Chung & Chang, 2017; Gao et al., 2017; Lindberg, Seo, & Laine, 2016), decrease body mass index (BMI) (Chung & Chang, 2017) and improve motor skills such as coordination (Hsiao & Chen, 2016). Other studies reporting positive findings examined how interactivity with games or programs and applications of various types impacted one or more health outcomes. These included programs or applications (apps) aimed at those with a special need. For example, Simmons, Paul, and Shic (2016) focused on a mobile app designed to treat speech disorders in children with autism spectrum disorder (ASD) or other communication impairments. An eight-week trial found positive effects on motivation and engagement, as well as on participants' speech skills.

Around a quarter of the studies included negative health and/or physical outcomes as a result of technology use. Contrary to expectations, a high proportion reported positive health effects. This is an interesting and important finding given the general consensus that technology negatively impacts health. This can be better understood by breaking down the study's findings.

Table 6: Outcomes breakdown for all health/physical literature

Health/physical outcomes	Number of papers	Percentage (%)
Predominantly positive effect	36	38
Predominantly negative effect	27	28
Mixed effect	20	21
No effects	12	13
Total	95	100

Table 7 provides details of outcomes relating to context for studies focusing on health/physical outcomes as a result of technology use.

Table 7: Outcomes as a function of context

Context	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Anywhere	17 (29%)	17 (29%)	17 (29%)	7 (12%)	58 (100%)
School	10 (59%)	3 (18%)	2 (12%)	2 (12%)	17 (100%)
Home	4 (29%)	7 (50%)	1 (7%)	2 (14%)	14 (100%)
Other	5 (83%)	0 (0%)	0 (0%)	1 (17%)	6 (100%)
Total	36 (38%)	27 (28%)	20 (21%)	12 (13%)	95 (100%)

Outcomes in the school context

Positive outcomes: Exergame studies

Several studies examined the effects of exergaming on various health and physical factors such as energy expenditure (Gao et al., 2017; Verhoeven, Abeelee, Gers, Seghers, & Seghers, 2015), physical activity (Maloney et al., 2012; Robert, Ballaz, Hart, & Lemay, 2013; Sun & Gao, 2016; Verhoeven et al., 2015) and motor skills (Hsiao & Chen, 2016). The majority reported positive outcomes. For example, Sun and Gao (2016) examined the effect of a science-learning active video game on science knowledge, motivation and physical activity (as measured by heart rate). In their study, a group of children in Years 3–5 were allocated to an experimental or control group. As well as finding higher learning gains and interest-motivation in the experimental group, the heart rate of the children in the active video game (experimental) group was observed to be in the target-heart-rate-zone (134 bpm). This was significantly higher than the average heart rate observed in the comparison group (103 bpm).

Positive outcomes: Non-exergame studies

Only two health/physical papers with positive outcomes in a school setting were non-exergame papers. Seomun et al. (2013) focused on a group of 40 students aged 12 years, and examined physical and psychological health effects of using a digital textbook for at least a year. Reports of effects were varied with some negative effects mentioned in the qualitative data collection; however, it was ultimately found that quality guidance in using the digital textbooks can prevent negative effects. In the second paper, Fassnacht, Ali, Silva, Gonçalves, and Machado (2015) examined adherence to, satisfaction with, and preliminary efficacy of mobile phone short message service (SMS) to promote health behaviours in a group of 49 students aged 8–10 years. They reported good adherence to and satisfaction with the program.

Negative outcomes

Two studies reported overall negative health and/or physical outcomes as a result of screen use in the school/educational context. Sun (2012) compared a four-week exergaming unit to a four-week fitness unit in a group of 74 students aged 9–12 years. They reported that interest in exergaming declined significantly over the four weeks, and activity levels were lower in the exergaming condition compared to the fitness unit. Another presented the findings of a study of Years 11 and 12 students participating in a tablet program (Sommerich, Ward, Sikdar, Payne, & Herman, 2007). Primary areas of interest were students' experiences with and attitudes about the tablets, physical discomfort associated with the use of tablets, and temporal and task-driven patterns of tablet use. Visual and musculoskeletal discomfort was prevalent.

Mixed outcomes

Two papers examining effects of screen use in the school context reported mixed health and/or physical outcomes. One focused on the effect of exergames on 9–12-year-old children's in-class physical activity intensity levels and perceived situational interest over time (Sun, 2013). The results showed that boys and girls were equally active in the exergaming lessons, and that physical activity increased over time: a positive finding. However, boys perceived their gaming experiences to be more enjoyable than girls did. The second paper assessed whether excessive screen time is associated with academic achievement in Japanese students (Morita et al., 2016). Excessive screen time was significantly related to lower grade point average in boys but not girls.

Conclusion about the school context outcomes

Overall, findings were largely positive in the school setting for health and physical outcomes. There were mostly exergame studies included in this category, and most exergame studies presented positive outcomes. Only negative exergame outcomes compared the exergame condition to actual physical fitness classes.

Outcomes in the home and anywhere contexts

There was a large overlap between the non-specific (anywhere) context and the home context in terms of how and where devices were or could be used. For this reason, we have combined these contexts in presenting outcomes in this section.

Positive outcomes

Papers in this category largely consisted of mobile health or game-based learning intervention studies designed to educate and improve health in various areas, and most were performed with adolescent/secondary school aged children. Health domains included, but were not limited to: optics/eye health (Birch et al., 2014; Webber, Wood, & Thompson, 2016), asthma (Cushing, Manice, Ting, & Parides, 2016; Greer, Lin, & Atkinson, 2017), diet, physical activity and/or weight (Nollen et al., 2013; Woolford et al., 2010) and sexual health (Shegog et al., 2017). For example, Nollen et al. (2013) examined the effectiveness of a mobile app designed to promote increased intake of fruit and vegetables in a group of 25 girls aged 8–15 years. They reported that attitudes to the app were overwhelmingly positive, and importantly, that the program significantly increased fruit and vegetable consumption.

Mixed outcomes

Topics of the studies with mixed health/physical outcomes in the home or anywhere contexts varied widely. They ranged from screen time studies examining the link between screen use and various factors such as physical activity (Sampasa-Kanyinga & Chaput, 2016), sleep (Punamaki, Wallenius, Nygard, Saarni, & Rimpela, 2007) or weight/BMI (Russ, Larson, Franke, & Halfon, 2009). Others focused on mobile health app interventions (Nystrom et al., 2017) or exergames (Mellecker & McManus, 2014). A small number focused on musculoskeletal effects of screen use, such as posture

and muscle activity (Maslen & Straker, 2009; Straker et al., 2008). Straker, Maslen, Burgess-Limerick, and Pollock (2009) examined and compared posture and muscle activity amongst children aged 5-6 years, 10-12 years and adults whilst working with computers. They found some negative effects on children's posture where they showed more spinal flexion and spinal asymmetry compared with adults. However, children also exhibited more variation in posture and muscle activity, which the authors suggested had the potential to mitigate negative effects. In a similar study, Maslen and Straker (2009) compared posture and muscle activity around the shoulder and neck in a group of children aged 5-6 years when they were using a tablet computer, a desktop computer or paper and pen. Use of a desktop computer was associated with less posture variability and muscle activity. Muscle activity was found to be similar for tablet and paper use, with greater muscle activity being observed compared to when using a desktop computer. Tablet use was also associated with a more flexed and asymmetrical spine. Tablet and paper use both resulted in a less neutral posture than using a desktop computer. However, the authors suggested the greater risk posed by non-neutral posture seen during tablet and paper use is likely offset by the greater muscle activity observed in these conditions (Maslen & Straker, 2009).

Negative outcomes

Sixteen studies reported negative health and/or physical outcomes related to screen/technology use in the home or anywhere contexts. Negative findings in this area were largely driven by studies focusing on screen time and health or physical outcomes. Almost half examined the link between screen time and sleep quality (e.g., Arora, Broglia, Thomas, & Taheri, 2014; Brambilla et al., 2017). The remainder examined screen time's link with various outcomes such as BMI/weight (e.g., Falbe et al., 2013) or mental health (e.g., Bickham, Hswen, & Rich, 2015; Woods & Scott, 2016). For example, Kenny and Gortmaker (2017) aimed to quantify the relationships between youth use of television and other screen devices—including smartphones and tablets—and obesity risk factors. They reported that watching television ≥ 5 hours daily was associated with daily sugar sweetened beverages consumption. Using other screen devices ≥ 5 hours daily was associated with daily sugar sweetened beverages consumption, inadequate physical activity and inadequate sleep. Another examined longitudinal associations between changes in screen time and mental health outcomes among adolescents (Babic et al., 2017). Changes in total recreational screen time and computer use were negatively associated with psychological wellbeing. An association was found with television/DVD use and psychological difficulties.

Only two papers were not screen time studies; both examined physical effects of using newer technologies such as a tablet or computer. Straker et al. (2009) compared posture and muscle activity in a group of 10-12-year-old children when they were using either a desktop computer or "old IT" (paper/pen/book). They found that posture was more neutral when using a computer; however, any benefits were likely offset by less variability in posture (less movement) and lower muscle activity compared to when using "old IT". The other also examined posture and muscle activity, as well as sedentariness and physical activity during tablet use compared to television watching and toy play in 3-5-year-old children (Howie, Coenen, Campbell, Ranelli, & Straker, 2017). Poorer neck posture was observed while the children were using a tablet computer versus watching television; and poorer neck posture, less posture variation and less physical activity was observed when they were using a tablet versus toy play. They concluded that increased tablet use carries a risk of musculoskeletal stress and increased sedentary behaviour.

Outcomes in the "other" context

The variability in the "other" context makes it difficult to draw strong conclusions. However, three exergame studies were carried out in a lab setting. Two reported positive effects of exergaming on energy expenditure (McNarry & Mackintosh, 2016) and mood experience (Ho, Lwin, Sng, & Yee, 2017). The final reported no difference in fitness improvements, body composition and cholesterol profiles

in overweight and obese teens as a result of playing an active game involving a stationary bike versus traditional cycling while listening to music (Adamo, Rutherford, & Goldfield, 2010). This is not a surprising result and in fact could be considered positive since it suggests that the stationary version was just as effective and could be a good alternative if there are barriers to being able to use a traditional bike.

One of the clearest outcomes in age analysis was that there were a great proportion of positive outcomes focused on the primary age cohort. The main difference between primary and secondary aged students were that a higher number of negative outcomes were found in the secondary school age cohort. These can be explained in terms of the type of studies they were, being predominantly screen time studies. Primary school age cohort studies were more varied in terms of topics covered and outcomes, and showed more positive outcomes overall. More specific details and examples of these kinds of studies are explained in **Table 8** as a function of context.

Table 8: Outcomes as a function of age

Age group	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Secondary school (13–18 years)	13 (30%)	17 (40%)	8 (19%)	5 (12%)	43 (100%)
Primary school (5–12 years)	20 (49%)	6 (15%)	9 (22%)	6 (15%)	41 (100%)
Mixed	2 (33%)	3 (50%)	1 (17%)	0 (0%)	6 (100%)
Preschool (<5 years)	1 (20%)	1 (20%)	2 (40%)	1 (20%)	5 (100%)
Total	36 (38%)	27 (28%)	20 (21%)	12 (13%)	95 (100%)

Table 9 details health/physical outcomes relating to type of digital devices examined.

Table 9: Outcomes as a function of digital device type

Device type	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Multiple	3 (10%)	15 (48%)	8 (26%)	5 (16%)	31 (100%)
Game console	13 (54%)	2 (8%)	5 (21%)	4 (17%)	24 (100%)
Tablet/Phone (touchscreen)	11 (52%)	8 (38%)	1 (5%)	1 (5%)	21 (100%)
Computer	3 (43%)	1 (14%)	3 (43%)	0 (0%)	7 (100%)
Other	3 (60%)	0 (0%)	2 (40%)	0 (0%)	5 (100%)
Virtual/Augmented reality	3 (75%)	0 (0%)	0 (0%)	1 (25%)	4 (100%)
Television/Video	0 (0%)	1 (33%)	1 (33%)	1 (33%)	3 (100%)
Total	36 (38%)	27 (28%)	20 (21%)	12 (13%)	95 (100%)

Conclusion

Papers examined focused on various types of media use including exergames and screen time, and their effects on or links with various health outcomes including weight, physical activity or sedentary behaviours, sleep quality and musculoskeletal effects. Most studies examined multiple devices or tablet/touchscreen use. Studies examining primary (5–12) and secondary (13–18) age cohorts made up almost 90% of those included. Most examinations of technology use were applicable to multiple contexts (e.g., school and home); fewer focused on the use of technology in the home, school or other context specifically.

Findings were predominantly positive for screen/technology use in relation to health and physical outcomes. Most of the studies that reported negative findings were screen time studies where time spent using screen media was linked to negative health or physical outcomes. However, it is notable that these were largely correlational and do not necessarily represent causal relationships. Positive findings were largely driven by studies examining exergaming and its effect on physical activity, energy expenditure and other measures of health or physical outcomes.

A small number of papers focused on musculoskeletal effects of technology use. Overall results of these were mixed, with some evidence that computer use can cause low muscle activity, and tablet use can cause a non-neutral posture. However, tablet use was found to be similar to pen and paper use in this regard and more research is needed to ascertain the implications of these findings.

There is a paucity of studies examining healthy media use in educational contexts, including few studies exploring an appropriate balance of physical activities with media in school or prior-to-school settings. Further, no studies examined here specifically assessed how technology use in educational settings effect sedentary behaviour. For example, a child writing a story in a book would be sedentary, as would a child writing on a tablet; and a child using a traditional flash card would be sedentary, as would a child learning from a series of language apps on a tablet (Kaufman et al., 2017).

The papers examined within this review suggest little evidence in any direction that technology use in educational settings impacts child health. The papers that did address this suggest that exergames had a generally positive effect. Studies that indicated negative impacts on health focused on excessive screen time as an issue, but these papers were not specifically related to educational contexts.

Of the limited papers in this area, a few key messages are:

- 1) Educators should take precautions to ensure that students adopt appropriate posture, musculoskeletal and physiological use of technologies (see Straker et al., 2008; Maslen & Straker, 2009). This includes ensuring students engage in a range of movements and positions during the day.
- 2) Given the positive impact identified in studies of exergames and e-health activities, these could be explored further in educational contexts, with additional studies to examine how these could promote healthy outcomes for children.
- 3) Excessive screen time and healthy media use also needs to be explored further in educational contexts. These could include comparative studies of physical activities with and without technologies.

Section 3: Systematic review of learning and educational outcomes of new technology use

Literature characteristics

There were 415 papers identified as relevant to this section and focus explicitly on learning and/or educational papers. While other papers also integrated opportunities for education or learning, these papers specifically focused on educational or learning outcomes for children and students. Papers that focus on teachers and/or parents are not included in this section; instead, they are discussed in Section 4.

These papers examined technology use in a range of contexts including home, school and informal learning contexts, including but not limited to, before and after school care, museums and galleries.

Table 10 presents an overview of these contexts.

Table 10: Context

Context	Number of papers	Percentage (%)
School	280	67
Other	108	26
Home	27	7
Total	415	100

The majority of the learning and educational research was conducted in educational settings, that is, school and prior-to-school settings.

As can be seen in **Table 11**, in relation to learning and educational outcomes, the majority of studies focused on the primary and secondary age cohorts (5–18 years). Far fewer examined preschool age (infancy–4 years). In order to categorise research that took place outside the Australian setting/within different school systems, we focused on the age range of the participants and what corresponding level of education they would be in if they were within the Australian context. For example, if a study focused on participants in the middle school setting, we categorised the study to either primary school or secondary school, depending on the actual age of the participants.

Table 11: Age

Age group	Number of papers	Percentage (%)
Primary school (5–12 years)	212	51
Secondary school (13–18 years)	107	26
Preschool (<5 years)	61	15
Mixed	32	8
Not specified	3	1
Total	415	100

Within these studies, technology was used in a range of ways. In some, students used devices alone and in others the device was used in collaboration with others (e.g., a peer, a teacher or a parent). Others still examined device use in multiple ways, for example, at times students used the device alone and at other times they used it in collaboration with others. A small number of papers (8%) did not specify how the device was used. **Table 12** shows that a relatively equal number of studies examined collaborative use and use alone, while slightly fewer studies examined multiple uses.

Table 12: Technology used alone/used with others

Social usage	Number of papers	Percentage (%)
Used with others	139	33
Used alone	130	31
Multiple	113	27
Not specified	33	8
Total	415	100

Technology use was categorised by engagement type, including: interactive technologies (that is, activities that required the child to interact with the content in some way including but not limited to clicking, dragging, creating, responding or designing); passive technologies (activities that required the child to view or read content); and exergames (activities that required the student to engage through physical activity or movement).

As can be seen in **Table 13**, the overwhelming majority of studies focused on interactive use of technology. This can also be understood in light of the digital device most commonly examined: touchscreen technology. Most touchscreen technology, particularly with educational or learning goals, is interactive in nature.

Table 13: Technology engagement type

Engagement type	Number of papers	Percentage (%)
Interactive	315	76
Any	41	10
Not specified	27	7
Passive	19	5
Mixed	8	2
Exergame	5	1
Total	415	100

As would be expected, a range of devices were included in these studies, including mobile and tablet devices, computers, game consoles, e-classroom resources (such as interactive whiteboards, collaborative classroom tools or projectors), and virtual or augmented reality tools. In addition to these tools or devices, a number of studies (18%) used multiple tools and a small sample used other tools (e.g., robotics) or did not specify their tool (8%).

Table 14 presents an overview of the device utilised in the examination of the effects of technology use on learning or education. The most common tools were mobile or tablet touchscreen devices (35%). Another 39% used either computers or multiple devices, and the remainder looked at other digital devices such as virtual or augmented reality, game consoles or e-classrooms.

Table 14: Digital device type

Device type	Number of papers	Percentage (%)
Tablet/Phone (touchscreen)	147	35
Computer	89	21
Multiple	75	18
Virtual/Augmented reality	48	12
Other/not specified	33	8
E-classroom (e.g., digital whiteboard)	18	4
Game console	5	1
Total	415	100

Technology and learning/educational literature results

Overall outcomes

The majority of the papers found predominantly positive learning/educational outcomes of technology use. **Table 15** presents an overview of the effects of technology on learning or education.

Table 15: Outcomes breakdown for all learning/education literature

Learning/educational literature	Number of papers	Percentage (%)
Predominantly positive effect	310	75
Mixed effect	76	18
No effects	16	4
Predominantly negative effect	13	3
Total	415	100

Despite a dominance of positive effects, it should be noted that most of these papers did not employ a non-technological control for comparison of learning outcomes (between a technology condition versus a non-technology condition). While control groups are common in some research forums within educational research, use of this methodology is not consistent, and within this sample most of the papers simply compare effects before and after learning from technology (without a control group).

The inclusion of a non-technology control condition in scientific research is important as it helps to eliminate some confounding factors and so allows us to conclude the learning effect is from the technology usage. With this in mind 106 papers included a control measure, with 81% of these classified as indicating a predominantly positive effect of technology on learning outcomes, 16% indicating a mixed effect and 3% indicating no effect. This means we can confidently conclude that the majority of research showed that children learn from technology.

Positive outcomes

Of the papers addressing educational and learning outcomes, 75% indicate positive outcomes, with children appearing to learn from technology. This finding is significant as learning occurred in a range of contexts (including prior to school, primary and high school contexts) and across a range of devices and modes of use. These papers indicate that students can learn with and from technology.

Across all school and prior-to-school settings, learning was demonstrated in a number of key learning areas such as literacy, mathematics and science. The role of factors such as interactivity and collaboration were also demonstrated. In prior-to-school settings and studies with children in the age range 0–5 years, the work of Schachter and Jo (2016) demonstrated the positive effects of a tablet-based mathematics app. Further, Smeets and Bus (2012) demonstrated how interactive features of an e-book can promote word learning compared to reading alone. In studies focusing on primary aged students, D’agostino, Rodgers, Harme, and Brownfield (2016) demonstrated the effectiveness of a letter learning iPad app. Further, Sun and Gao (2016) examined a science-learning exergame and demonstrated that it enhanced learning outcomes. Similar patterns were seen with older children, with many studies showing learning and positive educational outcomes. For example, Purba and Hwang (2017) reported positive learning outcomes for a physics learning app in a group of secondary school students and Yang and Wu (2012) found digital storytelling techniques enhanced English language learning whilst also increasing motivation. It is somewhat unsurprising that, given the current curriculum foci, many of the studies in school contexts focus on specific curriculum areas including mathematics, literacy and the sciences.

Negative outcomes

Approximately 3% of included studies reported negative learning or educational outcomes as a result of technology use. The focus of these varied widely and examples include, but were not limited to, studies examining transfer of learning (Moser et al., 2015; Strouse & Ganea, 2017; Zimmerman et al., 2015), e-books (e.g., Kelley & Kinney, 2017) and student attitudes about the implementation of technology in education (e.g., Duran & Aytac, 2016). Two examined transfer of learning using video versus three-dimensional demonstration and found that toddlers perform significantly worse when in the video condition (Moser et al., 2015; Zimmerman et al., 2015). This suggests that passive viewing doesn’t work. Another examined transfer of learning in the context of word learning from an e-book versus a traditional book, and the ability to generalise and transfer learning. Strouse and Ganea (2017) found that a group of 73 toddlers aged 17–23 months could learn from both an e-book and a traditional book, but only those in the traditional book condition could generalise the learning to other contexts. However, a group of 23 toddlers aged 24–30 months could generalise and transfer their learning (Strouse & Ganea, 2017). Also, focusing on e-books, Kelley and Kinney (2017) examined whether preschoolers learned better from an interactive versus not interactive storybook and found no enhanced learning effect in the interactive condition. The interactive condition in this study involved the children interacting with the book alone, and suggests learning by younger children benefits from educator facilitation. Another study which looked at reading found devices were underutilised for reading purposes, and that access to mobile phones and a greater range of digital devices was associated with reading infrequency (Merga & Roni, 2017).

Xu and Jang (2017) examined the relationship between extracurricular technology related activities (TRAs) and sixth graders’ mathematics achievement. Findings showed TRAs (including video gameplay, internet use and television viewing) had a negative effect on mathematics achievement. Kiefer et al. (2015) examined handwriting with pen and paper compared to using a computer keyboard with a group of preschoolers, and reported that handwriting with pen and paper was superior in word writing and word reading training. One study assessing educational gaming found that high-immersive games result in decreased learning, mediated by increased cognitive load (Schraeder & Bastiaens, 2012).

Two studies assessed attitudes (Bourgonjon, Valcke, Soetaert, de Wever, & Schellens, 2011; Duran & Aytac, 2016), and concerns were raised such as technology weakening communication between students and teachers and there not being any learning advantages to using tablet computers.

Mixed effects

Seventy-six papers (18%) examining technology use and learning or educational outcomes reported mixed results. These papers focused on many different areas, including but not limited to, e-books (e.g., Ma & Wei, 2016; Neumann, 2016; Ross, Pye, & Randell, 2016), game-based learning (e.g., Hong, Tsai, Ho, Hwang, & Wu, 2013; Ronimus, Kujala, Tolvanen, & Lyytinen, 2014) and the role of interactivity (e.g., Schroeder & Kirkorian, 2016). The nature of mixed effects varied, with some studies finding age differences (e.g., Schroeder & Kirkorian, 2016), gender differences (e.g., Hong et al., 2013) or a mixture of positive and negative effects for different outcomes measured (e.g., Hong et al., 2013; Neumann, 2016).

For example, Neumann (2016) focused on e-books, examining their use by 2–4-year-old children in the home setting, and their relationship with emergent literacy. They found a positive association between children's access to apps and their print knowledge, and also between frequency of writing using tablets and print awareness, print knowledge and sound knowledge. However, no link between frequency of e-book reading and emergent literacy was found (Neumann et al., 2016). Ross, Pye, & Randell (2016) also focused on e-book use in the home, examining interactive touchscreen versus print storybooks with 7-year-old child and mother dyads. They found story comprehension was far inferior in the touchscreen storybook condition, possibly due to a lot less time spent talking about the story. However, longer sessions and higher emotional engagement were also noted in the interactive touchscreen condition.

Studies examining game-based learning that reported mixed results generally focused on motivation and engagement (e.g., Ronimus et al., 2014) or learning gains (e.g., Hong et al., 2013; Jackson & McNamara, 2013). For example, Ronimus et al. (2014) measured engagement with a letter-sound training game over an eight-week period with Year 2 children. They found that while children reported enjoyment in using the game, interest declined over the study period and children did not spend as much time as expected each session using the game (Ronimus et al., 2014). Jackson and McNamara (2013) assessed both motivation and learning outcomes of a game-based learning system compared to an intelligent tutoring system. They found significantly higher levels of enjoyment and motivation in the game-based system condition, but learning gains were found to be equivalent across conditions. Hong et al. (2013) examined learning and motivation for an interactive video game compared to a blended learning approach with 4–5-year-old children. They found a blended learning approach that combines digital media and traditional classroom teaching methods was superior to purely digital learning. They also found gender differences, with boys' learning in the interactive video game condition being better than girls. Finally, the children found the interactive game entertaining and their interest remained high throughout the study.

Interactivity was also an area of interest, usually in combination with another topic such as those described above (e.g., e-books or transfer of learning) (e.g., Aladé, Lauricella, Beaudoin-Ryan, & Wartella, 2016; Schroeder & Kirkorian, 2016). For example, Schroeder and Kirkorian (2016) examined the role of interactivity in 3–5.5-year-old children's transfer of skills learning related to STEM, numerical cognition and knowledge of a biological concept (growth), and reported varied findings depending on age and condition (content and medium). The younger children only learned from the numerical cognition game when they watched as opposed to played the game, possibly because playing it proved too cognitively demanding for their ability levels. They also could not demonstrate transfer of learning. On the other hand, older children learned from the growth game when watching or playing, and demonstrated transfer of learning (Schroeder & Kirkorian, 2016).

As **Table 16** indicates, when taking into consideration context, studies with predominantly positive effects still made up the majority.

Table 16: Outcomes as a function of context

Context	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Other	218 (78%)	2 (1%)	53 (19%)	7 (3%)	280 (100%)
School	75 (69%)	10 (9%)	17 (16%)	6 (6%)	108 (100%)
Home	17 (63%)	1 (4%)	6 (22%)	3 (11%)	27 (100%)
Total	310 (75%)	13 (3%)	76 (18%)	16 (4%)	415 (100%)

Table 17 details learning/educational outcomes for each age group.

Table 17: Outcomes as a function of age

Age group	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Primary school (5–12 years)	169 (80%)	4 (2%)	29 (14%)	10 (5%)	212 (100%)
Secondary school (13–18 years)	82 (77%)	2 (2%)	19 (18%)	4 (4%)	107 (100%)
Preschool (<5 years)	37 (61%)	6 (10%)	16 (26%)	2 (3%)	61 (100%)
Mixed	20 (63%)	1 (3%)	11 (34%)	0 (0%)	32 (100%)
Not specified	2 (67%)	0 (0%)	1 (33%)	0 (0%)	3 (100%)
Total	310 (75%)	13 (3%)	76 (18%)	16 (4%)	415 (100%)

According to **Table 16** (Context) and **Table 17** (Age), the majority of the research was conducted in an educational setting (i.e., in schools). We also explored the age breakdowns in an educational setting only (see **Tables 18 and 19**).

Table 18: Outcomes as a function of age (school/educational context only)

Age group	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Primary school (5–12 years)	127 (80%)	1 (1%)	24 (15%)	6 (4%)	158 (100%)
Secondary school (13–18 years)	62 (81%)	0 (0%)	14 (18%)	1 (1%)	77 (100%)
Preschool (<5 years)	18 (64%)	1 (4%)	9 (32%)	0 (0%)	28 (100%)
Mixed	11 (65%)	0 (0%)	6 (35%)	0 (0%)	17 (100%)
Total	218 (78%)	2 (1%)	53 (19%)	7 (3%)	280 (100%)

Table 19: Outcomes as a function of technology usage (alone/with others)

Social usage	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Used with others	110 (79%)	1 (1%)	24 (17%)	4 (3%)	139 (100%)
Used alone	97 (75%)	5 (4%)	19 (15%)	9 (7%)	130 (100%)
Multiple	79 (70%)	5 (4%)	27 (24%)	2 (2%)	113 (100%)
Not specified	24 (73%)	2 (6%)	6 (18%)	1 (3%)	33 (100%)
Total	310 (75%)	13 (3%)	76 (18%)	16 (4%)	415 (100%)

Across all age group cohorts, about the same number of papers looked into the learning effect of children using digital devices alone or with others. A similar distribution of outcomes was shown in using technology alone and used with others; that is, the majority of the papers reported positive outcomes.

For the preschool cohort, only three studies examined the use of technology alone, and they all focused on word learning (Ellis & Blashki, 2007; Smeets & Bus, 2012; Smeets, van Dijken, & Bus, 2014). Smeets and Bus (2012) examined if extratextual vocabulary instructions in an e-book facilitates learning compared to just reading in a group of 4–5-year-old children. In one condition, a computer-based assistant embedded in the e-book asked questions in a multiple-choice format. In the other condition, the children read the e-book with no computer-based assistant. It was found that children learned more when they were presented with questions throughout the e-book, versus without. Smeets, van Dijken, and Bus (2014) examined the potential for e-books to support vocabulary acquisition in 4–5-year-old children with severe learning impairments. Static e-books and video e-books were examined and children learned from both; however, static e-books were found to be more effective in increasing knowledge of unknown words. The final paper also focused on 4–5-year old children, examining the acquisition of Australian Sign Language (Auslan) by using technology (Ellis & Blashki, 2007).

For preschool-aged children, there wasn't much evidence suggesting solo use is bad for learning outcomes; however, strong conclusions cannot be drawn because there is very little research focusing on solo use. This is potentially because it is not a common way of implementing technology usage for this age group. Most studies with preschool-aged cohorts examined technology use where it was used either with other children, with an adult, or with both. Areas examined varied, but included mathematics/STEM (e.g., Schachter & Jo, 2016), and literacy/word learning (e.g., Korat, Segal-Drori, & Klien, 2009).

For example, Schachter and Jo (2016) examined the effectiveness of a tablet-based mathematics learning app *Math Shelf* with 227 4-year-old preschool students. Results were positive for the app, with children in the *Math Shelf* app condition learning approximately one year more of mathematics than the control children did, who participated in regular mathematics classes (Schachter & Jo, 2016). Korat, Segal-Drori, and Klien (2009) compared the effect of e-books versus traditional books on emergent literacy with and without adult assistance. Among other findings, they reported that children learned best in the e-book condition when using it alongside an adult. These results support the findings of previously reviewed work of Kelley and Kinney, who also found that younger children learned better from an e-book when using it with an educator compared to alone. The importance of an educator in contributing to preschool children's learning from technology is also consistent with the data summarised in **Table 20**. Positive learning outcomes were common when children technology use involved other people (81%) than when it was used on their own (30%). Taken together, these

results suggest it could be particularly important that preschool-aged children use technology with an adult.

Table 20 displays outcomes of studies examining the preschool age only, relating to how the digital device was used (e.g. used alone, or with others).

Table 20: Outcomes as a function of usage (preschool age only)

Social usage	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Used with others	22 (81%)	1 (4%)	3 (11%)	1 (4%)	27 (100%)
Multiple	11 (58%)	1 (5%)	6 (32%)	1 (5%)	19 (100%)
Used alone	3 (30%)	2 (20%)	5 (50%)	0 (0%)	10 (100%)
Not specified	1 (20%)	2 (40%)	2 (40%)	0 (0%)	5 (100%)
Total	37 (61%)	6 (10%)	16 (26%)	2 (3%)	61 (100%)

Table 21 details learning/education outcomes relating to engagement type (e.g., interactive or passive).

Table 21: Outcomes as a function of engagement

Engagement type	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Interactive	245 (78%)	7 (2%)	51 (16%)	12 (4%)	315 (100%)
Any/not specified	44 (65%)	5 (7%)	17 (25%)	2 (3%)	68 (100%)
Passive	15 (79%)	1 (5%)	1 (5%)	2 (11%)	19 (100%)
Mixed	2 (25%)	0 (0%)	6 (75%)	0 (0%)	8 (100%)
Exergame	4 (80%)	0 (0%)	1 (20%)	0 (0%)	5 (100%)
Total	310 (75%)	13 (3%)	76 (18%)	16 (4%)	415 (100%)

Table 22 shows learning/education outcomes relating to engagement type for the preschool age only.

Table 22: Outcomes as a function of engagement (preschool age only)

Engagement type	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Interactive	27 (63%)	4 (9%)	11 (26%)	1 (2%)	43 (100%)
Any/not specified	8 (73%)	1 (9%)	1 (9%)	1 (9%)	11 (100%)
Passive	2 (50%)	1 (25%)	1 (25%)	0 (0%)	4 (100%)
Mixed	0 (0%)	0 (0%)	3 (100%)	0 (0%)	3 (100%)
Total	37 (61%)	6 (10%)	16 (26%)	2 (3%)	61 (100%)

Table 23 shows learning/education outcomes relating to type of device used.

Table 23: Outcomes as a function of digital device type

Device type	Predominantly positive effect	Predominantly negative effect	Mixed effect	No effects	Total
Tablet/Phone (touchscreen)	96 (65%)	6 (4%)	35 (24%)	10 (7%)	147 (100%)
Computer	74 (83%)	1 (1%)	12 (13%)	2 (2%)	89 (100%)
Multiple	49 (65%)	5 (7%)	20 (27%)	1 (1%)	75 (100%)
Virtual/Augmented reality	40 (83%)	1 (2%)	4 (8%)	3 (6%)	48 (100%)
Other/not specified	31 (94%)	0 (0%)	2 (6%)	0 (0%)	33 (100%)
E-classroom (e.g., digital whiteboard)	16 (89%)	0 (0%)	2 (11%)	0 (0%)	18 (100%)
Game console	4 (80%)	0 (0%)	1 (20%)	0 (0%)	5 (100%)
Total	310 (75%)	13 (3%)	76 (18%)	16 (4%)	415 (100%)

Section 4: Systemic review of the literature on teachers’ use of new technology in the classroom

A total of 150 papers focused primarily on teachers and parents. A systematic review of this group of papers did not yield significant results, with only two key findings arising from the systematic analysis:

- 1) There is indication of a growing interest in technology use in prior-to-school settings, with this age group being the focus of increasing studies published in the last three years.
- 2) In recent years, a growing number of papers have examined the use of mobile and tablet devices, with a move away from research examining touchscreens and interactive whiteboards.

A general review of these papers shows a range of findings. The papers addressed teacher or parent perceptions and included a broad range of engagement with technology, including studies examining attitudes, engagement, and experience with and use of technologies in a range of contexts including prior-to-school, primary and high school settings. Several papers also focused on pre-service teachers’ attitudes and experiences in university contexts (for example, Diaz, 2016).

A number of these papers examined models of effective technology use in schools, such as the “flipped classroom”, computer-supported collaborative learning, games-based learning and alignment of technology use to theoretical models such as Technological Pedagogical and Content Knowledge (TPaCK) and Substitute, Augmentation, Modification and Redefinition (SAMR). In addition, a collection of papers in this group focused on specific technology tools, apps or software, interactive whiteboards, personal mobile technologies and tablet use. Two methodological approaches were dominant: qualitative approaches such as case studies (including collective case studies) and practitioner inquiry; and mixed methods (including surveys, interviews and focus groups). Few of the papers could be meaningfully classified as having a single clear outcome or as having used a specific technique for classroom integration. While this makes tabulating the papers according to predetermined criteria problematic, we instead reflect on repeatedly appearing themes in this group of studies. These themes include:

- 1) Teacher and parent perceptions of technology are important, with educators needing to indicate a willingness to engage with and use technology in their settings. Educators who demonstrate a willingness to use technology generally indicate positive effects from these tools (for example, Wong, 2016).
- 2) Almost all studies outline specific benefits of technology use for student learning in educational contexts; however, many focus on specific curriculum areas, tools, software or apps, and as these papers are specific in nature, their findings may not be generalisable (for example, Savage et al., 2010).
- 3) Technology use appears to present specific pedagogic benefits, such as facilitation of content creation, communication and collaboration. Specifically, cloud-based computing and presentation tools (such as interactive whiteboards) demonstrate potential benefits from a pedagogic perspective (for example, Bourbour and Masoumi, 2017; Maher et al., 2012).

Stage 1 conclusion

The predominant finding of Stage 1 is that there were very few negative effects on children's development from them using technology in an educational context. The findings of this stage provide answers to some of the research questions. These will be discussed further in the section: Response to Research Questions.

Stages 2 and 3

Within Stage 2, a collection of 56 policy statements, position statements and guidelines were collected. These included documents from local, national and international groups, as well as from educational groups and peak bodies. Documents were located through systematic searches as well as through publication referrals and suggestions from participants in Stage 4 (see below).

In examining these guides, it is beneficial to specify the main types collected:

- **Policy Statements** which include documents labelled as such or documents that comprise a research-based set of guiding principles to direct and define engagement. For example, the American Academy of Pediatricians labels documents as "policy statements". Policy statements on the whole are research based and often provide rationale for the policy.
- **Position Statements** define a position or perspective designed to direct engagement. These include documents labelled as such (for example, the Prevention Research Collaboration [2011] defines its document as a position statement). However, given that position statements are similar to policy statements in function and purpose, they have been grouped together in this document.
- **Guidelines** are documents that outline or guide specific behaviours. These documents are often short statements or brochures, are prescriptive and may not be supported by research literature. Guidelines within this report also refer to a collection of documents that are labelled as such: for example, the Canadian Sedentary Behaviour Guidelines for the Early Years – 0–4 Years.
- **Derivative statements** are documents that reiterate another guideline, policy or position statement. Within this project, two documents were used consistently as the basis for derivative documents: the American Academy of Pediatrician's policy statements and the Australian Department of Health's Physical Activity and Sedentary Behaviour Guidelines.

In addition to these documents, a range of brochures, information sheets, presentations, academic articles, online posts and newspaper articles were also collated. The following section presents an analysis of these sources and key messages, describing how these documents are supported by research literature.

Age focus

Of the 56 documents collated, a significant proportion of these (46%) addressed both prior-to-school and school-aged children. Further details of the age classification are specified in **Table 24**. Of note here is the proportion that focus on children aged birth to five years, or birth to eight years (n=15). While there are several plausible reasons for this focus, it is most likely that it is due to the contentious nature of technology use in this age group, and so is an age group where parents and educators are seeking guidance.

Table 24: Age group focus for documents outlining a position, policy or guideline

Age group	Number of papers	Percentage (%)
Multiple age groups (i.e., including school and prior-to-school)	26	46
Prior to school or early childhood focus (0–5 or 0–8 focus)	15	27
Age group unspecified	8	14
School aged (including K–6 and 7–12 focus)	7	13

Country of origin

Despite searching for documents across all countries and reaching out to organisations at state, national and international levels, the majority of documents were obtained from Australia, the United States of America, the United Kingdom and Canada. **Table 25** presents a breakdown of position, policy and guideline documents by country.

The limited number of references available internationally is of interest; in part, this reflects the timing of policy focus in both Canada and the USA, which has been particularly active during this time period. The increased number of documents from Australia is noteworthy and is further analysed below.

Table 25: Country of origin for documents outlining a position, policy or guideline

Country of origin	Number of papers	Percentage (%)
Australia	29	52
United States of America	17	30
Canada	6	11
United Kingdom	4	7

Year of publication

An analysis of the year of publication (see **Table 26**) reveals a spike of interest in this area over the last few years.

Table 26: Year of publication

Year of publication	2006	2007	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	No date evident
	1	0	0	0	0	1	3	3	2	0	4	16	10	16

Australian document types

A range of document types were evident in the Australian sample, with several having overlapping codes (resulting in a total of 40 items); for example, a document could be classified both as “an online blog or newspaper article” and “reiterate Australian guidelines” (see **Table 27**).

Table 27: Document types for Australian papers

Document type	Number of papers	Percentage (%)
Online blog or newspaper article	18	45
Reiterating Australian Sedentary Behaviour Guidelines	11	28
Guideline	7	18
Deciphering or replicating AAP Guidelines	2	5
Policy or position statement	2	5

Analysis of Australian documents

The 29 Australian documents reflect a range of age groups within their foci, with seven focusing on early childhood (0–8 years of age) exclusively, four focusing on school-age groups exclusively, and 10 focusing on both early childhood and school-aged students. A further eight documents did not specify an age focus.

Fifteen of these documents were authored by government bodies or educational authorities, such as the Australian Government Department of Health or state-based education authorities and ten of these documents were authored by authoritative groups, such as the Raising Children Network, medical organisations or KidsMatter. Only three peak bodies for medical organisations (focusing on optometry, vision and occupational therapy) were represented in the Australian documents, which differs to both Canada and the USA, where peak medical bodies such as the American Academy of Pediatricians and the equivalent Canadian body are dominant voices. The remaining documents were from media outlets or were academic papers (written to support and justify policy statements).

Academic rigour

An examination of the combined international and Australian documents highlights a limited academic rigour and thus presents a significant challenge for educators and parents as they grapple with conflicting and at times confusing messages. For example, of the current documents, 64% did not include references or links to academic sources, nor evidence supporting their assertions. While several of these did link to additional websites, there was limited transparency and limited connection to research supporting the statements and opinions expressed. It should be noted that some of these

documents may have been based in research, however the lack of transparency with this is problematic. **Table 28** presents an overview of citations by country.

Table 28: References used in international documents

Country of origin	No references Included	5 or fewer references	Link to policy guidelines (e.g., AAP or Australian Sedentary Behaviour Guidelines) only	Detailed references included
Australia	23 (41%)	1 (2%)	1 (2%)	4 (7%)
USA	8 (14%)	3 (5%)	3 (5%)	3 (5%)
Canada	3 (5%)	0 (0%)	0 (0%)	3 (5%)
UK and Europe	2 (3%)	0 (0%)	0 (0%)	2 (3%)

Only 28% of the documents analysed included references; of these, 21% had more than 10 references and the remaining documents had four or fewer references. The most dominant references these materials refer to are the American Academy of Pediatrics Guidelines or Australia’s Sedentary Behaviour Guidelines.

Academic rigour in Australian documents

As demonstrated in **Table 28**, of the 29 Australian documents, 23 have no references; while some of these have links to external sources (such as websites), none have transparent links to research papers. One has less than five citations, one links exclusively to the Australian Sedentary Behaviour Guidelines, and only four have detailed citations, with each citing between 14 and 30 research papers in their justification.

Of note, few of the Australian guidelines obtained can be deemed academically rigorous (i.e., a document with links to appropriate research and thus some degree of academic and professional rigour). The most rigorous of these is the 2012 Australian Physical Activity and Sedentary Behaviour Guidelines which were based on the GRADE approach to performing systematic reviews. Another document with clear research links was specifically written for Australian schools (it was an online article commissioned for independent schools in NSW). Notably, most of the Australian documents do not have education as the its main focus but instead focus on sedentary behaviour, active play and screen time as a health concern.

Challenges to authenticity

The documents analysed, including from both international and Australian sources, present significant challenges for readers, with authenticity and authorship questionable in many cases. For example, a 2016 document from the MayoClinic on screen time and children’s health, while suggesting some helpful ideas for parents and educators, does not support its commentary with transparent links to research. Given that the MayoClinic is perceived as a credible and authoritative (health-based) source, this presents a challenge.

A secondary challenge is that a number of authoritative sources that present opinions on screen time and engagement with media do so with little or no academic rigour. As parents and educators grapple with these ideas this is a significant challenge, and transparency of the research foundation underpinning guidelines is needed.

Stage 4

Sample

The recruitment of participants for Stage 4 commenced by contacting the key stakeholder organisations including education authorities, education peak bodies, parent advocacy groups, health-based organisations and resource organisations (further defined below). During recruitment, reference was also made to the organisations who have published guidelines which had been collected for the study. This initial list of organisations to be contacted was built upon using recommendations from the research team's experience in the field of education as well as suggestions gathered from participants within their interviews, thereby generating a snowball sample (where participants were asked to recommend other parties to interview). In total, 52 organisations were contacted and invited to participate in the study via a telephone call and email from the research team. The majority of organisations were Australian, with a number also contacted in the USA and Canada. The organisations invited to participate in the study were located within prior-to-school, outside school hours, primary and secondary education contexts and from health disciplines. Five broad categories of organisations were invited to participate in interviews for this study, defined by the research team as:

- 1) **Education Authorities:** National and state/territory-based education authorities that have responsibilities in relation to education policy, regulation and monitoring.
- 2) **Education Peak Bodies:** National and state/territory-based peak organisations that may represent educators, school principals, early learning services, schools and systems.
- 3) **Parent Advocacy Groups:** Organisations representing parents that may or may not be associated with specific educational contexts, including national, state/territory and system-based groups.
- 4) **Health-based Organisations:** Federal and state/territory government departments, peak bodies and professional groups from health disciplines.
- 5) **Resource Organisations:** Other government and non-government agencies, groups or networks with a role in providing advice, information or resources to educators, including health, parenting and education-related organisations.

The number of organisations in each of these five categories who were invited to participate in the Stage 4 interviews are provided in **Table 29**. Subcategories relating to the educational contexts, which these organisations primarily represent, have responsibility for or are otherwise associated with (where applicable) are detailed in **Table 30**.

Table 29: Organisations invited to participate in Stage 4, by category of organisation

Category of organisation	Number invited
Education authority	11
Education peak body	18
Parent advocacy group	5
Health-based organisation	10
Resource organisation	8
Total	52

Table 30: Organisations invited to participate in Stage 4, by educational context

Organisation's educational context	Number invited
Prior-to-school	14
Outside school hours	3
Primary	27
Secondary	23
Total	67

Note: Some organisations fit within more than one educational context (that is, their organisational interest spans multiple ages or contexts), so these numbers include all age groups the organisations support or are relevant to.

From the 52 organisations invited to participate in the study, 17 participants were interviewed, each from a different organisation, representing a 33% participation rate. A further five organisations explicitly declined to participate in this stage of the study stating that they did not believe they were the most appropriate organisation to comment about the use of digital technologies in education settings or it was not their role to have a position on such matters. The remaining 30 organisations either did not respond at all to initial telephone or email communications from the research team, or did not follow up initial enquiries with a response to either accept or decline the invitation to participate. The sample of organisations, from which representatives were interviewed for this study, are detailed in **Tables 31** and **32**. Brief, de-identified details of each of the participants who were interviewed for Stage 4 of this project are included in **Table 33**.

Table 31: Stage 4 sample—interview participants' organisations by category of organisation

Category of organisation	Number interviewed
Education authority	3
Education peak body	7
Parent advocacy group	2
Health-based organisation	1
Resource organisation	4
Total	17

Table 32: Stage 4 sample—interview participants' organisations by educational context

Organisation's educational context	Number interviewed
Prior to school	5
Outside school hours	1
Primary	10
Secondary	8
Total	24

Note: Some organisations fit within to more than one educational context (that is, their organisational interest spans multiple ages or contexts), so these numbers include all age groups the organisations support or are relevant to.

Table 33: Participant details

Participant	Category of organisation	Educational context
01	Parent advocacy group	Primary, Secondary
02	Education peak body	Primary
03	Education peak body	Secondary
04	Education peak body	Prior-to-school, Primary, Secondary
05	Education peak body	Prior-to-school, Primary, Secondary
06	Resource organisation	N/A
07	Resource organisation	N/A
08	Education authority	Prior-to-school, Primary, Secondary
09	Resource organisation	N/A
10	Education peak body	Primary
11	Education peak body	Primary, Secondary
12	Education authority	Primary, Secondary
13	Parent advocacy group	Primary, Secondary
14	Education peak body	Prior-to-school
15	Health-based organisation	N/A
16	Resource organisation	N/A
17	Education authority	Prior-to-school, Outside school hours

Method

All participants were interviewed by telephone and the interviews were audio-recorded and transcribed. The interviews were short, with an average length of 14 minutes, and were conducted between 30 August and 19 September 2017. The semi-structured interview guide which was used is included in **Appendix A**; it consisted of a broad opening question about the organisation's position on the use of digital technologies in the educational context and further questions about processes informing this position as well as guidelines utilised. The final question for participants asked for suggestions of other stakeholders the research team could invite to participate in the study. The data were coded with the assistance of QSR NVivo 11 into four broad themes related to the project. The identities of organisations and individuals are protected in this report by the use of participant codes and by taking all reasonable steps to remove other information in the data which may potentially identify an organisation or individual. These ethical considerations were important in this stage of the study for the engagement of stakeholders in interviews relating to their organisation's views. In addition, one participant requested that the audio file of their interview be deleted immediately after transcription and this request was honoured by the research team.

Results

The results of the interviews conducted in Stage 4 of this study are presented under four themes, relating to the aims of this phase of the research:

- 1) Positions
- 2) Processes
- 3) Guidelines
- 4) Emerging trends and issues

Positions

The participants articulated a range of positions on the use of digital technologies in education contexts. However, it is important to note that the majority of the organisations that the interview participants represented did not have a formal position on digital technology use in educational contexts. For example, Participant 05 clarified, in response to the first interview question relating to the organisation's position: "I'll have to speak out of my understanding of that..."; and Participant 09 stated: "Well we don't have a written statement about that but if I could extrapolate from our position on a range of things...". Further, several participants said that it was not the aim of their organisation or appropriate for them to have a position on this or other issues. For example, a number of participants stated that it was their role to provide information, rather than have a formal position.

I wouldn't say that we have a position per se. I would say that it's a great area of interest for our [members] ... so how we've chosen to deal with that as an organisation is to provide information sessions and expert knowledge and made that available to members so that could inform their position ... we are cautious of doing a blanket statement about our position on things because each and every school has their own philosophy and interests ... so that's why we're hesitant to say 'full stop we sit in one way or another'. (Participant 13)

I would like [educators] to be informed before they take a meaningful position on technology, it's not for us to say. (Participant 14)

[the organisation] does not have a position ... we refer to the experts in the field: we ... look at the research evidence ... and then we translate that evidence into accessible materials... (Participant 16)

It's just not within our scope to go 'we're the authority on this and here's our stuff'. We will come across [information] and share it and [educators] need to look at what this looks like in the context of [their] service. (Participant 17)

In response to being asked about their organisation's position on the use of digital technologies in the educational context, given the absence of a formal position, many participants needed to reflect on their individual views, and personal and professional experiences, to respond to this particular interview question. Therefore, the data reported here reflect a blend of official positions as well as individual views of key people within these organisations.

A range of positions on the use of digital technologies were described by participants, including positive support for their use to enhance learning outcomes, as well as caution in integrating technology, particularly in education settings with very young children. Examples of positive support for the use of digital technologies in the educational context included:

We're a very big believer in it. We've got clear policy on the importance of digital education in enabling us to support modern education outcomes for our students and critical to making sure they've got the life skills necessary to succeed in the workplace and as productive members of society in the future. (Participant 08)

We are very, very, actively bringing digital technologies into all of our syllabuses. We are very, very supportive and ... pro-active so at the moment ... we've actually developed a new syllabus that really promotes project work and coding, computational thinking right [through primary school] ... I think that signals our intent that we are promoting it very, very strongly. (Participant 12)

Some responses were positive about the use of digital technologies in the educational context, but participants added some considerations around how they are used. Some examples are cited here, and some of the considerations are explored further in Results Stage 4: Emerging Trends and Issues.

[Our] position is [for educators] neither to be dazzled by the technology and the latest things and neither to be fearful of it: that we would see it as yet another tool in the toolkit ... but that it's a tool to be thoughtful about ... thinking about the ethics of using it, thinking about the good practices and behaviours that go with that and what are the implications for the role of the educator would be the really crucial thing. (Participant 14)

We recommend a balanced approach across the board though which is cognisant of student's age, the curriculum, learning requirements and making sure there's a balanced part of education so you walk into our schools where technology is being used effectively to support student learning and growth and it's not like all the kids are sitting there in front of a device staring at the screens all day: they are active and vibrant places to be so that's what we mean by a balanced approach. (Participant 08)

...the organisation would take the view that if digital technology is being used in formal childcare and education settings then account needs to be taken of what use is being made of digital technology in other settings ... I think if it is going to be used in an early childhood setting or an educational setting, it should be done with a view to what we know about children ... the organisation takes the view based on that research that young children need a balance of activities in their lives... (Participant 09)

Our position is that [digital technology] is an essential part of the skills that young people need to acquire in preparing them for future work and because we see it as a vital skill we are, I suppose our overlay is the fact that when any digital technologies are used in an education context that safety is always front and centre, regardless of which area of the curriculum it is being used. (Participant 07)

[Digital technology is] one of the utilities of learning that is here to stay, quite clearly but we've got to be very careful about letting it run what we do as opposed to let the learning and the relationships and the engagement of the human factor, the key consideration around the delivery of teaching and learning. It's a balance ... as educators, we need to try and prepare kids for the future ... the reason we do this is about trying to prepare kids so they've got all of the tools that they need ... that they've got a good skill-set that's adaptive to the world they're going to... (Participant 11)

The position that we have in relation to the use of digital technologies in schools is that we acknowledge the benefits that technology can bring and the need that all children in Australia have to be acquainted with not just how to use the technology but the technology itself. So we appreciate the focus now on such things as coding and programming and the things that go beyond just straightforward use of the technology for education. However, we are cautious around the implementation of the technology in terms of as a cost to parents, the equity across all communities and the involvement of parents in the digital decisions of schools. (Participant 01)

...we are all in favour of the use of technology provided it's used appropriately, it's used responsibly and it doesn't become a substitution just for pen or paper or teacher... (Participant 03)

Other responses expressed caution about the use of technology in education settings, particularly for young children, and described a position which related to non-use.

...we do see that one of the reasons why you probably won't find computers and screens in the early years is that we give a very high priority to the child constructing their own personality and becoming their own human being ... we feel that those tools can be very useful in the older age groups ... but for the younger children there are other priorities that we would see as more important in the environment ... [We believe in] the importance of face to face human contact and the development of language: all of those things we see as extremely fundamental to child development and we don't want anything that would be an obstacle to the child developing those things. (Participant 04)

Our position would be that children need to develop the correct muscles and things in their hands for their fine motor skills and that starts from a very early age ... we would always be encouraging parents to get their children to use crayons and pencils to develop those skills and I suppose my concern is that with increased screen time they don't get to develop everything they need to ... Our advice would be no screen time for children under two years and to limit it to an hour a day for children under five years... (Participant 15)

We also believe [in] the richness of ... authentic experiences [and that these] are really important and so we ... do not use any digital devices for teaching in early childhood. (Participant 05)

Processes

Interview participants were asked about the processes that have informed their organisation's position on the use of digital technologies in the educational context. The processes described varied from conducting their own research in various forms, including national surveys; the use of reference groups, external experts, forums and social media campaigns; information in the mainstream media; reference to published empirical research; and considering curriculum expectations, guiding principles of the work of organisations and philosophies of education. Examples provided by participants of their processes included:

...there's been a very rigorous process at the organisation gathering information, digesting it and applying it to policy debates and this is no exception so the position that we take is based on decades of research, of engaging research and keeping aware of what's coming out... (Participant 09)

...[our] education system is based on principles ... so when we're looking at technology we're looking at how does this tool help us in our lives and how can we best use it as a support and a help and what limits might need to be around our use of the technology so that we are responsible. So rather than having a position whereby we would prescribe a certain amount of screen time or not, we haven't found that, we haven't got any statements on that. We would go back to our principles and look at each situation... (Participant 04)

I suppose it's our own research [that has informed our position] which we have done a significant amount of research over the years... (Participant 07)

We're in a very informed time at the moment. I think the media has been part of that ... the ABC recently [ran] the series on Artificial Intelligence which was quite an opportunity for a thinking moment for many people in communities, not just in the school community but education community... (Participant 11)

The main thing is the Australian Curriculum. It has to be implemented but we also believe that it is a good thing, that it will be implemented. That's the main area but we also through reading a number of publications like from the Chief Scientist, the CEDA [Committee for Economic Development of Australia] report there is very, very clear evidence that these are skills that our students are going to need for the future and if we don't do this, our students are going to, they'll be disadvantaged. (Participant 12)

...we have had a researcher who we asked to keep us up to date with that area and who maybe 8 years ago ... wrote something and then updated it a year or two ago. (Participant 05)

I think a lot of it comes from evidence that's been collected from speaking to various schools, school principals. I think it's been derived from looking at when policy was rolled out and what came out to support that policy, there was not a lot to support the policy that came out so that's where we have developed our position on the use of technology. (Participant 03)

...in order for kids to participate they need to have access to digital experiences both educationally and otherwise. Again, it comes back to, not so much direct evidence of particular forms of digital technology and what works but more that broad principle that if children are to flourish and have their wellbeing enhanced that they all need to have those opportunities. (Participant 06)

A range of particular information sources which were specifically mentioned in interviews in relation to processes informing positions on the use of digital technologies in educational contexts included:

- Individual researchers and experts. Those named by participants were predominantly international scholars, including:
 - Professor Chip Donohue (Erikson Institute and Director of Technology in Early Childhood Centre)
 - Dr Michael Levine (founding Executive Director of the Joan Ganz Cooney Center at Sesame Workshop)
 - Dr Warren Buckleitner (Editor and founder of the electronic resource *Children's Technology Review*)
 - Professor Lydia Plowman (Chair in Education and Technology; and Dean of Research, College of Arts, Humanities and Social Science at The University of Edinburgh)
 - Dr Justin Coulson (presenter and author from HappyFamilies.com.au)—the only Australian presenter mentioned
- Australian Government authorities, offices, peak bodies and companies, such as the:
 - Office of the eSafety Commissioner
 - Australian Communications and Media Authority
 - Australian Government Department of Health
 - Education Services Australia
- American authorities and peak bodies, including the:

- American Academy of Pediatricians
- NAEYC Fred Rogers Centre Statement on technology and young children
- USA organisation ASCD (formerly the Association for Supervision and Curriculum Development)
- Alliance for Childhood and their publications such as *Fool's Gold* and *Tech Tonic*
- Specific services, consultancies and resources, including:
 - Digital education companies and consultants such as ScopeIT
 - The short film, *Screenagers*
 - The Committee for Economic Development of Australia (CEDA) 2015 report, *Australia's Future Workforce?*

It is evident in the responses to this interview question—particularly from those who stated that their organisation did not have a formal position—that personal experiences can inform the participant's professional view of the use of digital technologies. Several participants relayed anecdotes from personal or professional experiences as examples to illustrate the points they made in relation to their organisation's position on the use of digital technology. Examples included descriptions of parents' use of screens with very young children, the inappropriate use of social media by students in secondary schools, and their own experiences of using or implementing digital technology in educational contexts. For example, Participant 15 related a personal experience with a mother and her baby which illustrated her organisation's position on the use of digital technologies.

I'm thinking 'look at this beautiful mum and she's looking down at her child' ... and then as I walked past she had her iPhone like on the handle [of the pram] and wasn't looking at her baby at all and I suppose that whole thing of the mothers are not being responsive so it's not the children using the screens but the mothers using the screens I feel is interfering with the attachment and responsiveness.

Guidelines

The third interview question in this study asked participants if their organisation has followed or implemented formal guidelines in relation to the use of digital technologies in educational contexts. Some responded by saying that it was not their organisation's role to implement guidelines and that many school education systems already have policies around the appropriate use of technology. Participants 14 and 17 identified that guidelines for digital technology use are a particular "gap" in the prior-to-school and out-of-school-hours educational contexts. Other participants also recommended that further work was needed around particular technology issues to develop relevant guidelines. Comments in relation to the use of guidelines included:

I think schools are developing [policies/guidelines] on their own. I think systems and sectors have developed some guidelines, most of the guidelines appear in schools around what's appropriate use of technology. It's more about, it's not about using it as a teaching tool or a learning tool, it's more about making sure kids don't use it inappropriately, Facebook, that sort of stuff. (Participant 3)

...there's an expectation that ICT is taught, it's delivered in the teaching of every syllabus ... it is expected that it is integrated right through the curriculum. But we don't have guidelines for screen time or anything like that. (Participant 12)

We don't have a particular policy about the amount of time children spend on their screens. (Participant 02)

Usually the schools themselves would have a policy because technology is a big part of the curriculum so they would have their own approach and so you would

often find in classrooms for primary-aged children and definitely for secondary-aged children that there would be different technology, screen based activity. (Participant 04)

I know there was a statement about screen use by the American Academy of Paediatrics ... a couple of years ago and I know that the organisation really embraced that at the time ... but that's going back a few years now and I think since then we're aware that the conversation has gone on to recognise that digital technology just sort of exists in the lives of children and particularly in children under two and it's a very nice thing to aim for to keep their lives free of digital technology but it's just not realistic...(Participant 09)

Well we do have for school leaders a document ... it's a checklist about areas that we think will help make the use of technology in schools safer. (Participant 07)

We basically use the Australian Curriculum as the fundamental source for opportunities for technology ... so that's the key anchor document for all of what we do with our schools. To assist with school's uptake we have a range of different policies around ICT acceptable usage that includes some of the basics such as screen time, OH&S considerations, cyber safety, a range of different material, support and guidelines for schools with that. We also heavily use the Office of the eSafety Commissioner for best practice material to support students and parents... (Participant 8)

...no screen time for children under two years and to limit it to an hour a day for children under five years... (Participant 15)

Emerging trends and issues

In discussing their organisation's positions, a large number of issues related to the use of digital technologies in the educational context emerged. The issues go far beyond those listed as risks of using digital technologies in the background to the draft interim report (such as screen time and cyber safety), and include many of the practicalities of integrating technology into educational contexts. Issues which participants articulated included:

- Research, policy and positional concerns:

In school contexts it is difficult for policy and guidelines to keep up with changes in technology; given the rapid evolution of technologies guidelines are soon outdated. This is combined with the lack of information from authoritative sources to inform educators about which digital technologies really make a difference creates confusion. This confusion is amplified with decisions related to selection of software and hardware being influenced by marketing and advertising. In prior to school contexts there is a perceived lack of information about the effective use of digital technology with very young children. Frequently information and guidelines available are targeted at parents, or other guidelines/policies are written for schools, not prior-to-school settings, thus the question remains "what does this mean for educators" of young children?

- Home, community and school contexts and perspectives including:

There is an identified need to collaborate with families in writing technology policies, including understanding the wider community perception of technology use in educational contexts. This includes a need for educational policy be based on an understanding of how children use digital technologies both at home and in out-of-school contexts, particularly young children. For example, it is important to consider how parents and educators manage screen time when children are using digital technologies both at home and in educational settings. Further, there needs to be a recognition

that the use of digital technology has created significant issues and “a whole layer of complexity” and challenges for education settings and families. For example, “bring your own device” (BYOD) systems or bringing school devices home has created a host of issues for schools and families.

These concerns are amplified with the media portraying an image of digital technology use by children as a negative. This perception of technologies does not accurately reflect the research and has influenced early childhood educators by being translated into non-use, particularly of screen based technologies. These concerns, including parental concerns can often be seen in the tension between the view of technology as occupying or entertaining children versus the view of it being a learning and education tool.

- Context based challenges including staffing and infrastructure:

Within some schools and prior to school contexts there appears a lack of professional skills in using technology effectively. This includes the knowledge of in-service teachers, the preparation of new teachers and is exacerbated by few professional development opportunities around using technology to enhance learning outcomes and as a learning tool. In the words of one participant, some educators have “integrated it into their space, but not into learning”. These context-based concerns include infrastructure concerns such as the lack of technical assistance for education settings and technical support, broadband and access related issues.

Illustrative examples from the data in relation to issues and trends include:

...I think a lot of people who have integrated it into their space have not really integrated it into learning or for making meaning with children. What I hear is ‘yes, we’ve got iPads: they’re locked in the cupboard’ children can only access them after they have finished, inverted commas, their real work. I think that sends the message of its only for entertainment, it’s not a serious tool, that it’s excluded from the learning process... (Participant 14)

We would believe that there is not enough information around to support teachers and school leaders around making decisions around so what are the best school-based tools, to support learning? (Participant 10)

...people have just kind of done what they think is the right thing [in using digital technologies] and that’s where I think some more formal guidelines [would be useful] that people can take into consideration when they’re developing what their position is at a service level and maybe large providers [should be] thinking about it for all their services in their overarching philosophy ... it comes down to services to decide why they want to use it and how they use it ... what the outcome is for children using it I think sometimes people forget about. (Participant 17)

There’s your two hours which everyone is quite familiar with as being healthy screen time allocation, however, how does that two hours’ work [at home] when you’ve actually already been at school on your device for the day? (Participant 13)

I think there are parents that because we are providing the device then we need to control the use of the devices at home. They don’t want to take responsibility for their child’s use of the device or technology. They want us to say that they can’t use them for these hours or they can only use them, they want direction around that, they don’t want to parent... (Participant 02)

I think one of the biggest concerns that we have is that we have all of this technology but we don't necessarily have the teachers who have the expertise to use the technology effectively and in effect what in a lot of cases the technology has been used purely as a substitution rather than using it to the proper effect that will improve outcomes for students ... We rolled out a lot of the technology with the digital education revolution ... we put computers into the hands of every student Year 9 to 12 in secondary schools across Australia and yet we didn't give the teachers any expertise in how to use that technology effectively. (Participant 03)

...the current guidelines for screen time are very out-dated and they are not reflective of current technology ... and secondly [there] is the issue in education around bring your own device [BYOD]. That has cost implications. I don't know that parents are informed well enough what benefits that brings. It becomes our problem after 3 o'clock when the school bell rings in terms of monitoring that use. Whilst the school insists that students must have these devices, not enough work is done between home and school to help with the issues that parents have to face when they bring that technology from school, home and also the time of implementation: it's certainly not a voluntary thing, it's not optional. You are told when you enrol your child in some schools that by Year 1 they must have an iPad... (Participant 01)

...it's important that people don't get fixated on digital technology as the thing or the solution. I think if it works well it is a complement to what's going on in the broader context of a child's educational experiences. People can get a bit starry-eyed with new technology coming on which looks really sleek and fascinating, again unless we go back to those principles around effectiveness, age-appropriateness, access, we don't necessarily know that it's going to have the best outcomes for people. (Participant 06)

Limitations

This study has a range of limitations in Stages 1, 2 and 3. These include limitations such as access to position statements and limitations of search terms in the systematic review. To mitigate these, snowball methodology was adopted to enable the inclusion of these sources and position statements.

Stage 1 has a specific set of limitations. One limitation to this work is related to the breadth of methodologies in the literature. One approach to our Stage 1 exercise could have been to limit our analysis to studies with comparable measures of learning across multiple variables. For example, regarding learning outcomes, this approach could have limited its scope to studies that included a non-technology control and had similar pre-intervention and post-intervention tests. The benefit of such an approach is that it would allow for a meta-analysis across studies and more easily summarised results. This report did not take this approach, however, because the breadth of methodologies and investigation strategies in the literature would have required a very narrow window into current findings. To allow for a wider window into the overall findings coming out of the literature, we took a more general view that allows us to describe the extent to which studies describe technology use as affecting learning and health.

A second limitation relates to possible publication bias. Publication bias is a type of bias that occurs when the outcome of an experiment or research study influences the decision whether to publish or not. Interestingly, the likely publication biases in this case work in different directions for health and learning outcomes. Specifically, most work on screen use and health outcomes hypothesise negative

effects related to screen use—whereas work on learning generally hypothesises positive learning outcomes. If researchers are less likely to publish null effects, it is possible that our analyses were unable to capture unpublished studies that failed to show negative health effects or failed to show positive learning effects.

A third limitation is that there is simply very little data on specific health outcomes related to classroom use of educational technology. We would be able to make stronger recommendations regarding classroom incorporation of technology if we had more information on health effects related to such usage. In the absence of data in this area, we instead base some of our recommendations on a logical argument. Specifically, as the bulk of the reported health effects related to screen use stem from sedentary activity, it stands that using technology at school should not lead to increased health risks if the alternative is a sedentary non-technology related activity. However, we do advise future research to specifically assess whether technology use in educational settings has an impact on physical activity throughout the school day.

A fourth limitation is based on the lack of literature related to learning outcomes from touch screen apps sold directly to parents for home use. The majority of the learning/educational studies analysed in Stage 1 related to use in school or preschool settings. While this is an important topic to address, the lack of data on learning from educational apps at home is a serious problem limiting how much we can conclude/recommend about educational touchscreen apps for children (particularly young children) at home. It is because of this limitation that we largely restrict our recommendations about educational technology to use in the school environment.

A fifth limitation relates to factors that facilitate use of technology at schools. This is the literature that revealed the greatest methodological variability across studies. We recommend that future studies in this area examine facilitation of a specific set of technologies across multiple educational contexts. This would allow us to draw clearer conclusions about which factors are most important for specific types of educational technology.

Stage 4 has a specific set of limitations. For example, the nature of the sample has created some limitations to the results of this study. The sample is limited to those representatives of stakeholder organisations who were able to participate in a telephone interview at relatively short notice. Once university ethics approval was granted, the research team had only a three-week period to recruit participants and conduct interviews. This time limitation meant that some internal processes within the identified organisations prevented access to potential participants. These internal processes included requests for formal research approval before participants could be approached, and response times to the research team's telephone and email communications. The requirement for formal research approval was the reason why only one state or territory education department was able to be interviewed for this project; five departments indicated this would be needed before the research could proceed. Two other departments indicated that they didn't believe approval was required and communicated that they would make internal enquiries to find out, but further enquiries by the research team were not responded to. The time was not available in this study to complete written applications to conduct research and wait for assessment and approval, which various departments indicated would take between 6–12 weeks.

Timing also limited the sample related to the way research requests are handled within the organisations invited to participate in this study; for example, although many organisations were contacted by telephone in the first instance, they also requested the invitation details be sent by email. The timeframe between first contact with an organisation and receiving a reply varied from prompt responses to delays of several days (for example, some email invitations were not replied to until 12 days later, or in some cases, not at all).

In addition to time and internal process limitations, some organisations who were invited to participate did not view having a position on the educational use of digital technology as part of their role and declined to be interviewed, stating that it was up to individual schools or children's services

to develop policies around digital technology use. It is important to note that several early childhood and special education organisations did not respond to the research team’s invitation to participate, therefore the sample is limited, with a couple of exceptions, to participants of organisations representing primary and secondary education contexts.

In lieu of interview data from state and territory education departments, a list of their policies in relation to the safe use of digital technology are available on the Office of the eSafety Commissioner website.¹

Response to research questions

As outlined in the methodology, the current project can be framed to respond to a number of primary and secondary research questions. The following section presents each of these questions in turn for discussion.

Primary questions

1) What is the current range of research in this area, and what are the key issues that have been highlighted in the research?

As outlined in this report there is a vast range of research in this area. However, research appears to focus on two main realms: health-related issues including sedentary behaviour and active engagement, and educational potentials of technology. A significant number of studies examined here outline educational opportunities of technology use across a range of settings, with many smaller-scale studies suggesting potential affordances of technology—when used appropriately.

A key issue arising from this research is that the two areas of healthy media use and educational media use appear to be vastly separate—additional work that explores these intersections is needed. These studies need to both examine technology use and health impacts with a large cohort sample to enable representative analysis in educational contexts.

2) What are the factors which have the greatest influence on the exposure of children to screen time in educational settings?

Teacher perceptions appear to be one of the largest driving factors in screen time use in educational settings; these data arrive from both published papers examined in the systematic review and in the interview data. While not fully articulated in the research papers examined here, but further examined in the interview data, the second largest driving factor is contextual, financial and budgetary. Contextual factors include parental expectations, and school and systemic leadership and available support for technology use; financial and budgetary factors can be seen as derived from these, with parental, school or systemic support leading to financial support that enables technology purchase, infrastructure and use. These findings appear particularly relevant in prior-to-school contexts where there appears to be some choice in technology engagement. These data contrast to school contexts where there appears to be a more widespread expectation from parents and the school context to use technology.

3) What is the impact of the use of digital technologies on children’s health and development outcomes in an educational setting?

There are very few studies that explore the impact of digital technologies on children’s health and development outcomes specifically in educational settings, with most studies in educational contexts not mentioning health outcomes and development. Of the studies that do address this specifically (outlined in Stage 1, Section 2) the key areas of concern are on the musculoskeletal impacts of using

¹ <https://www.esafety.gov.au/education-resources/school-policies/national-and-state-education-department-policies>

digital technologies. These data suggest that educators should adopt precautions to ensure appropriate posture and that children engage in a range of movement throughout the day. Given that exergames offer potential positive impacts for educational contexts it is suggested that use of these tools be further researched alongside studies that promote healthy media use in educational contexts.

Interview data indicates that educators appear cognisant of the importance of balanced/healthy technology use and most teachers and educational leaders have both sound pedagogic understanding and the best interests of their students at heart (as outlined in Stage 4). Thus, there appears to be a trend in using technology in a balanced and appropriate way. Given this data, it appears likely that these devices have minimal impact on students' overall health and development.

4) What is the interaction between screen time use for education and entertainment?

There appears to be little interaction between research examining screen time use for education and entertainment, with studies exploring entertainment largely occurring in the home and those exploring education largely occurring in educational contexts. In educational contexts most of these studies are around engagement with screen time as a learning tool rather than a true examination of the nexus between education and entertainment. Interview data indicated little focus on screen time use for entertainment, with a strong focus on educational outcomes arising from screen time.

5) What are the most effective types of digital technologies for improving learning outcomes?

The notion of the most effective types of digital technologies on improving learning outcomes is complex and not yet fully explored. This is a limitation in the current research corpus, where there are some conflicting studies presenting challenging data.

However, the work of Hirsh-Pasek et al. (2015) perhaps provides the most thorough examination of apps and learning outcomes to date, with a focus on learning sciences informing and leading digital technology use, rather than digital technology leading classroom learning. Further to this work, educator guided and purposeful use of technology also appears to promote effective use, as opposed to student selected or "free use" (or student-led use) of technology.

6) What is the current range of guidelines on screen time and the use of digital technologies in an education setting and how do they respond to research in the area?

As outlined in Stages 2 and 3, there are a wide range of guidelines on screen time use, however few provide much clarity regarding what research findings support their recommendations. The Australian Physical Activity and Sedentary Behaviour Guidelines, US National Association for the Education of Young Children (NAEYC) and Fred Rogers position paper (NAEYC and the Fred Rogers Centre, 2012) and the American Academy of Pediatrician's guidelines (AAP, 2016) most clearly explained how their recommendations related to empirical research. Notably the authors of most of these documents identify the challenges of providing evidence-based recommendations with ongoing and emerging research necessitating frequent revisions to maintain currency.

Further, the current guidelines focus predominantly on health-related issues generally, with few examining or outlining use specifically in educational settings. This is challenging as educational settings are unique contexts; for example, while many guidelines focus on reducing sedentary behaviour the nature of learning in educational settings can at times be sedentary.

It is noteworthy that several of the school based educational bodies interviewed indicated a need for research based guidelines, but few indicated that they had an intention to develop guidelines for educational contexts, citing challenges with currency and time to identify research and develop appropriate positions as a key concern. Early Childhood Australia (ECA) are in the process of developing a digital technology research based guideline for young children. To avoid duplication of effort the government could consider partnering with ECA (or other organisations carrying out such work) to develop guidelines for young children in the prior-to-school and first years of school. Further to this, the Office of the eSafety Commissioner has a number of documents including a checklist for

schools that could form the basis of a partnership to develop guidelines in school contexts. Both these organisations have strategic links and authority within their sectors, with the ability to oversee states and territories, as they are also outside their sectors.

7) Is there any evidence that current guidelines have been successful in influencing the use of digital technologies by children in educational settings?

In school contexts, there is limited evidence of the current guidelines influencing the use of digital technologies of children. A possible contributing factor to this could be confusion as to whether the Australian Sedentary Behaviour Guidelines refer specifically to “recreational use” of media and screens, or whether they pertain to all screen use. It is also plausible that school decision-making processes around technology primarily focus on its use as an appropriate pedagogic tool rather than as a determinant of general health outcomes. This is consistent with the scientific literature on child technology use which consists largely of studies on learning from technology and the social issues/risks associated with use by school-aged children (e.g., e-safety and cyber bullying).

In prior-to-school contexts, particularly in New South Wales (where the *Munch and Move* program is active), there is some evidence that the current guidelines have had an impact. In our study, there were a number of services that were reluctant to use technology, which may imply the guidelines simplified by *Munch and Move* (suggesting educators “turn off the screens and get active”) have been successful. This success is somewhat challenging as it is plausible that educators have misunderstood notions of balanced or pedagogically appropriate use.

8) Is there a model of “best practice” in the use of digital technologies in preschool, primary school and high school regarding which risks of using digital technologies can be ameliorated and positive outcomes maximised? What are the most effective pedagogies for incorporating digital technologies into an educational setting?

The research examined here suggests that “best practice” with digital technologies in educational contexts needs to first and foremost be activities that are informed by the science of learning (e.g., Hirsh-Pasek et al., 2015). For example, students learn best when an activity involves “minds on” interaction (i.e., an interactive activity that requires the child to think about the material in order to receive positive feedback), when the digital elements enhance rather than distract from the learning material, and when the material involves some social interaction. Social interaction could involve collaborative use with peers and/or involvement with the student’s teachers or caregivers.

Further, effective and responsive educators will judiciously choose resources, be they digital or otherwise, that meet the learning needs of their students and that are linked to the pedagogic goal of the lesson. Interview data suggests that most educators are actively engaged in these choices, however we need to be cognisant of ensuring that the educational goal drives the learning and resource choices (with technology supporting these goals)—rather than choosing technologies that drive the learning.

Secondary questions

1) Is there a need for national guidelines on the amount of time children use digital technologies in educational settings? If so, what should these guidelines include and why? Could a screen time limit practically apply to different types of digital media, e.g., interactive versus passive? Would these guidelines change for different educational settings or age groups and why?

This report recommends that the development of national guidelines on the use of screen time in educational settings may be beneficial. However, rather than merely prescribing time limitations we recommend that these guidelines need to focus on effective use of technologies. This could include management of time, such as avoiding prolonged periods of time in one position (be it with technology or traditional learning media such as books), and notions of healthy use such as avoidance of

inappropriate content or advertising. Further, these guidelines should also promote healthy media use in the broadest sense, to include examination of e-safety and cyber bullying.

Moreover, guidelines should ensure that they suggest activities that will have the greatest learning potential as informed by the science of learning (e.g., Hirsh-Pasek et al., 2015) as well as by this review. For example, children learn best when an activity involves “minds on” interaction (i.e., an interactive activity that requires the child to think about the material in order to receive positive feedback), when the digital elements enhance rather than distract from the learning material, and when the material involves some social interaction. Social interaction could involve collaborative use with peers and/or involvement with the student’s teachers or caregivers.

This document does not recommend a specific time limit per type of device or type of activity. Such an endeavour would likely prove confusing to stakeholders as different devices and even different activities can lead to both passive and active elements. More generally, however, it is clear that among the key messages that should be included in educational technology use guidelines is that children of all ages learn best when the activity requires interaction and ideally incorporates social engagement.

2) What is the interaction between time spent on educational purposes and entertainment— should there be separate limits in addition to total limits?

The reasons underlying calls for screen time limits are largely based on research investigating how entertainment media affects children outside of the educational context. As the findings from this review demonstrate that children (from preschool ages upward) often learn from educational technology, we recommend that well informed use of technology in primary and secondary schools need not contribute to screen time limits. With respect to technology use by preschool-aged children, it is particularly important that new technologies do not disrupt opportunities for social interaction or physical activity. For this reason, we see some value in counting sedentary and/or non-social technology usage in preschool settings towards screen-time limits. This is especially important if the technology-related activity is displacing other activities that involve physical activity and social interaction.

3) If a screen time limit isn’t practical, what other ways can educators reduce the risks associated with the use of digital technologies by children and maximise learning outcomes and wellbeing?

Regarding the maximising of learning, see our response to Secondary Question 2 above. Regarding minimisation of risks, several strategies can be considered, for example:

- Encouraging children to undertake a range of movements while using a tablet and not staying in one position for an extended period of time.
- Using tablet cases/stands that encourage a more neutral posture while using tablet devices.
- Ensuring screen use in the school setting does not increase children’s overall duration of sedentary time during the school day. More research needs to be conducted to ascertain if screen time in the educational context is linked to sedentary time.
- Incorporating screen based activities that encourage physical activity, such as active games or health based educational apps.

References

- AAP Council on Communications and Media (2016). Media and Young Minds. <http://pediatrics.aappublications.org/content/early/2016/10/19/peds.2016-2591>
- AAP Council on Communications and Media (2016). Media Use in School-Aged Children and Adolescents. <http://pediatrics.aappublications.org/content/early/2016/10/19/peds.2016-2592>
- About Kids Health (2016). Screen Time: Overview. <http://www.aboutkidshealth.ca/En/HealthAZ/HealthandWellness/PhysicalActivitySportsandFitness/Pages/screen-time-overview.aspx>
- Abrami, Philip C.; Wade, C. Anne; Lysenko, Larysa; Marsh, Jonathon; Gioko, Anthony (2016). Using Educational Technology to Develop Early Literacy Skills in Sub-Saharan Africa. *Education and Information Technologies*, 21 (4): 945--964.
- Acha, Joana (2009). The effectiveness of multimedia programmes in children's vocabulary learning. *Br. J. Educ. Technol.*, 40 (1): 23-31. doi:10.1111/j.1467-8535.2007.00800.x
- Adamo, Kristi B.; Rutherford, Jane A.; Goldfield, Gary S. (2010). Effects of interactive video game cycling on overweight and obese adolescent health. *Appl. Physiol. Nutr. Metab.*, 35 (6): 805-815. doi:10.1139/H10-078
- Adhikari, Janak; Scogings, Chris; Mathrani, Anuradha; Sofat, Indu (2017). Evolving digital divides in information literacy and learning outcomes A BYOD journey in a secondary school. *Int. J. Inf. Learn. Technol.*, 34 (4): 290-306. doi:10.1108/IJILT-04-2017-0022
- Akard, Terrah Foster; Dietrich, Mary S.; Friedman, Debra L.; Hinds, Pamela S.; Given, Barbara; Wray, Sarah; Gilmer, Mary Jo (2015). Digital Storytelling: An Innovative Legacy-Making Intervention for Children With Cancer. *Pediatr. Blood Cancer*, 62 (4): 658-665. doi:10.1002/pbc.25337
- Akgunduz, Devrim; Akinoglu, Orhan (2017). The Impact of Blended Learning and Social Media-Supported Learning on the Academic Success and Motivation of the Students in Science Education. *Egit. Bilim*, 42 (191): 69-90. doi:10.15390/EB.2017.6444
- Akpinar, Yavuz; Aslan, Umit (2015). Supporting Children's Learning of Probability Through Video Game Programming. *J. Educ. Comput. Res.*, 53 (2): 228-259. doi:10.1177/0735633115598492
- Alade, Fashina; Lauricella, Alexis R.; Beaudoin-Ryan, Leanne; Wartella, Ellen (2016). Measuring with Murray: Touchscreen technology and preschoolers' STEM learning. *Comput. Hum. Behav.*, 62: 433-441. doi:10.1016/j.chb.2016.03.080
- Alhinty, Mona (2015). Young Language Learners' Collaborative Learning and Social Interaction as a Motivational Aspect of the iPad. *Int. J. Emerg. Technol. Learn.*, 10 (2): 24-29. doi:10.3991/ijet.v10i2.4313
- All About Vision (2016). Children and Computer Vision Syndrome. <http://www.allaboutvision.com/cvs/children-computer-vision-syndrome.htm>
- Allen, Melissa L.; Hartley, Calum; Cain, Kate (2015). Do iPads promote symbolic understanding and word learning in children with autism? *Front. Psychol.*, 6: 138. doi:10.3389/fpsyg.2015.00138
- Al-Mashaqbeh, Ibtisam Fares (2016). iPad in Elementary School Math Learning Setting. *Int. J. Emerg. Technol. Learn.*, 11 (2): 48-52. doi:10.3991/ijet.v11i02.5053
- Altenderfer, Eliza; Doerfler, Amanda; Poblete, Erika; Williamson, Marissa; Yenika-Agbaw, Vivian (2012). Traditional Tales and Literacy: Pre-Service Teachers' Transmediation of Hansel and Gretel. *Journal of Language and Literacy Education*, 8 (1): 38--49.
- Altura, Gerard J.; Curwood, Jen Scott (2015). Hitting Restart: Learning and Gaming in an Australian Classroom. *J. Adolesc. Adult Lit.*, 59 (1): 25-27. doi:10.1002/jaal.438
- Alvarez, M.; Torres, A.; Rodriguez, E.; Padilla, S.; Rodrigo, M. J. (2013). Attitudes and parenting dimensions in parents' regulation of Internet use by primary and secondary school children. *Comput. Educ.*, 67: 69-78. doi:10.1016/j.compedu.2013.03.005
- Amornchewin, Ratchadaporn; Sitdhisanguan, Karanya (2017). Evaluation of the impact of tablet screen size on children tracing performance. *Artif. Life Robot.*, 22 (2): 191-196. doi:10.1007/s10015-016-0343-0

- Anderson, Craig A.; Bushman, Brad J.; Donnerstein, Edward; Hummer, Tom A.; Warburton, Wayne (2015). SPSSI Research Summary on Media Violence Analyses of Social Issues and Public Policy, 15 (1): 4--19.
- Andrade Xavier, Michelle Katherine; Rodarti Pitangui, Ana Carolina; Reis Silva, Georgia Rodrigues; Alves de Oliveira, Valeria Mayaly; Beltrao, Natyia Barros; de Araujo, Rodrigo Cappato (2015). Prevalence of headache in adolescents and association with use of computer and videogames. *Cienc. Saude Coletiva*, 20 (11): 3477-3486. doi:10.1590/1413-812320152011.19272014
- Annetta, Leonard A.; Cheng, Meng-Tzu; Holmes, Shawn (2010). Assessing twenty-first century skills through a teacher created video game for high school biology students. *Res. Sci. Technol. Educ.*, 28 (2): 101-114. doi:10.1080/02635141003748358
- Annetta, Leonard A.; Minogue, James; Holmes, Shawn Y.; Cheng, Meng-Tzu (2009). Investigating the impact of video games on high school students' engagement and learning about genetics. *Comput. Educ.*, 53 (1): 74-85. doi:10.1016/j.compedu.2008.12.020
- Annetta, Leonard; Mangrum, Jennifer; Holmes, Shawn; Collazo, Kimberly; Cheng, Meng-Tzu (2009). Bridging Realty to Virtual Reality: Investigating gender effect and student engagement on learning through video game play in an elementary school classroom. *Int. J. Sci. Educ.*, 31 (8): 1091-1113. doi:10.1080/09500690801968656
- Apostolakis, Konstantinos C.; Psaltis, Athanasios; Stefanidis, Kiriakos; Kaza, Kyriaki; Thermos, Spyridon; Dimitropoulos, Kosmas; Dimaraki, Evangelia; Daras, Petros (2016). Exploring the prosociality domains of trust and cooperation, through single and cooperative digital gameplay in Path of Trust. *Int. J. Serious Games*, 3 (3): 39-57. doi:10.17083/ijsg.v3i3.125
- Arbogast, Helen; Burke, Rita V.; Muller, Valerie; Ruiz, Pearl; Knudson, Margaret M.; Upperman, Jeffrey S. (2014). Randomized controlled trial to evaluate the effectiveness of a video game as a child pedestrian educational tool. *J. Trauma Acute Care Surg.*, 76 (5): 1317-1321. doi:10.1097/TA.0000000000000217
- Ardito, Carmelo; Costabile, Maria F.; De Angeli, Antonella; Lanzilotti, Rosa (2012). Enriching Archaeological Parks with Contextual Sounds and Mobile Technology. *ACM Trans. Comput.-Hum. Interact.*, 19 (4): 29. doi:10.1145/2395131.2395136
- Ardito, Carmelo; Lanzilotti, Rosa; Costabile, Maria F.; Desolda, Giuseppe (2013). Integrating Traditional Learning and Games on Large Displays: An Experimental Study. *Educ. Technol. Soc.*, 16 (1): 44-56.
- Aronin, Sara; Floyd, Kim K. (2013). Using an iPad in Inclusive Preschool Classrooms to Introduce STEM Concepts. *Teaching Exceptional Children*, 45 (4): 34--39.
- Arora, Teresa; Broglia, Emma; Thomas, G. Neil; Taheri, Shahradsad (2014). Associations between specific technologies and adolescent sleep quantity, sleep quality, and parasomnias. *SLEEP MEDICINE*, 15 (2): 240--247.
- Arrow, Alison W.; Finch, Brian T. (2013). Multimedia literacy practices in beginning classrooms and at home: the differences in practices and beliefs. *Literacy*, 47 (3): 131-141. doi:10.1111/lit.12006
- Association of Independent Schools of New South Wales Limited (2015). Link issue 2 - Managing attention span in the Digital Age. <https://aisnsw.edu.au/Services/EducationResearch/Latest%20Research%20Documents/Link%20issue%20%20Attention.pdf>
- Australasian College of Behavioural Optometrists (2011). Computer Vision Syndrome. www.acbo.org.au
- Australian Council for Educational Research. (2010). Using television to improve learning opportunities for Indigenous children. [Camberwell, Vic.]: Australian Council for Educational Research, <http://nla.gov.au/nla.arc-124002>
- Australian Government - esafety commissioner (2017). Managing online time. <https://www.esafety.gov.au/education-resources/iparent/staying-safe/balancing-time-online/managing-online-time>

- Australian Parents Council (2016). Screentime.
https://austparents.edu.au/parentech_resources/screentime
- Avery A, Anderson C, McCullough F. (2017). Associations between children's diet quality and watching television during meal or snack consumption: A systematic review. *Matern Child Nutr.* 13(4). doi: 10.1111/mcn.12428.
- Axelsson, Anton; Andersson, Richard; Gulz, Agneta (2016). Scaffolding Executive Function Capabilities via Play-& Learn Software for Preschoolers. *J. Educ. Psychol.*, 108 (7): 969-981. doi:10.1037/edu0000099
- Babic, Mark J.; Smith, Jordan J.; Morgan, Philip J.; Eather, Narelle; Plotnikoff, Ronald C.; Lubans, David R. (2017). Longitudinal associations between changes in screen-time and mental health outcomes in adolescents. *Ment. Health Phys. Act.*, 12: 124-131. doi:10.1016/j.mhpa.2017.04.001
- Badia, Antoni; Meneses, Julio; Fabregues, Sergi; Sigales, Carles (2015). Factors affecting school teachers' perceptions of the instructional benefits of educational digital media. *RELIEVE*, 21 (2): 1. doi:10.7203/relieve.21.2.7204
- Baggett, Kathleen M.; Davis, Betsy; Feil, Edward G.; Sheeber, Lisa L.; Landry, Susan H.; Carta, Judith J.; Leve, Craig (2010). Technologies for Expanding the Reach of Evidence-Based Interventions: Preliminary Results for Promoting Social-Emotional Development in Early Childhood. *Topics in Early Childhood Special Education*, 29 (4): 226--238.
- Baki, Adnan; Gueveli, Ebru (2008). Evaluation of a web based mathematics teaching material on the subject of functions. *Comput. Educ.*, 51 (2): 854-863. doi:10.1016/j.compedu.2007.09.003
- Baranowski, Tom; Abdelsamad, Dina; Baranowski, Janice; O'Connor, Teresia Margareta; Thompson, Debbie; Barnett, Anthony; Cerin, Ester; Chen, Tzu-An (2012). Impact of an Active Video Game on Healthy Children's Physical Activity. *Pediatrics*, 129 (3): E636-E642. doi:10.1542/peds.2011-2050
- Barbovschi, Monica; Machackova, Hana; Olafsson, Kjartan (2015). Underage Use of Social Network Sites: It's About Friends. *Cyberpsychology Behaviour and Social Networking*, 18 (6): 328--332.
- Baser, Derya; Ozden, M. Yasar; Karaarslan, Hasan (2017). Collaborative project-based learning: an integrative science and technological education project. *Res. Sci. Technol. Educ.*, 35 (2): 131-148. doi:10.1080/02635143.2016.1274723
- Bebell, Damian; Pedulla, Joseph (2015). A Quantitative Investigation into the Impacts of 1:1 iPads on Early Learners' ELA and Math Achievement. *J. Inf. Technol. Educ.-Innov. Pract.*, 14: 191-215.
- Bebell, Damian; Pedulla, Joseph (2015). A Quantitative Investigation into the Impacts of 1:1 iPads on Early Learners' ELA and Math Achievement. *J. Inf. Technol. Educ.-Innov. Pract.*, 14: 191-215.
- Bedford, Rachael; de Urabain, Irati R. Saez; Cheung, Celeste H. M.; Karmiloff-Smith, Annette; Smith, Tim J. (2016). Toddlers' Fine Motor Milestone Achievement Is Associated with Early Touchscreen Scrolling. *Front. Psychol.*, 7: 1108. doi:10.3389/fpsyg.2016.01108
- Bekele, Esubalew; Crittendon, Julie; Zheng, Zhi; Swanson, Amy; Weitlauf, Amy; Warren, Zachary; Sarkar, Nilanjan (2014). Assessing the Utility of a Virtual Environment for Enhancing Facial Affect Recognition in Adolescents with Autism. *J. Autism Dev. Disord.*, 44 (7): 1641-1650. doi:10.1007/s10803-014-2035-8
- Bentley, Georgina F.; Turner, Katrina M.; Jago, Russell (2016). Mothers' views of their preschool child's screen-viewing behaviour: a qualitative study. *BMC Public Health*, 16: 718. doi:10.1186/s12889-016-3440-z
- Benzing, Valentin; Heinks, Theda; Eggenberger, Noemi; Schmidt, Mirko (2016). Acute Cognitively Engaging Exergame-Based Physical Activity Enhances Executive Functions in Adolescents. *PLoS One*, 11 (12): e0167501. doi:10.1371/journal.pone.0167501
- Bereznak, Sally; Ayres, Kevin M.; Mechling, Linda C.; Alexander, Jennifer L. (2012). Video Self-Prompting and Mobile Technology to Increase Daily Living and Vocational Independence for Students with Autism Spectrum Disorders. *J. Dev. Phys. Disabil.*, 24 (3): 269-285. doi:10.1007/s10882-012-9270-8

- Berninger, Virginia W.; Nagy, William; Tanimoto, Steve; Thompson, Rob; Abbott, Robert D. (2015). Computer instruction in handwriting, spelling, and composing for students with specific learning disabilities in grades 4-9. *Comput. Educ.*, 81: 154-168. doi:10.1016/j.compedu.2014.10.005
- Berrios, Llarella; Buxarrais, Maria-Rosa; Garces, Maria-Soledad (2015). ICT Use and Parental Mediation Perceived by Chilean Children. *Comunicar*, (45): 161-168. doi:10.3916/C45-2015-17
- Bicen, Huseyin; Uzunboylu, Huseyin (2013). The Use of Social Networking Sites in Education: A Case Study of Facebook. *J. Univers. Comput. Sci.*, 19 (5): 658-671.
- Bickham, David S.; Hswen, Yulin; Rich, Michael (2015). Media use and depression: exposure, household rules, and symptoms among young adolescents in the USA. *International Journal of Public Health*, 60 (2): 147--155.
- Birch, Eileen E.; Li, Simone; Jost, Reed M.; Subramanian, Vidhya; Morale, Sarah E.; Stager Jr., David; Dao, Lori; Stager Sr., David R. (2014). Binocular iPad treatment for amblyopia in preschool children. *Journal of American Association for Pediatric Ophthalmology and Strabismus*, 18 (4): e1-e2.
- Bittman, Michael; Rutherford, Leonie; Brown, Jude; Unsworth, Lens (2011). Digital natives? New and old media and children's outcomes. *Aust. J. Educ.*, 55 (2): 161-175.
- Blackwell, Courtney K.; Lauricella, Alexis R.; Wartella, Ellen (2016). The influence of TPACK contextual factors on early childhood educators' tablet computer use. *Computers & Education*, 98: 57--69.
- Blaszczak-Boxe A (2016). Healthy Viewing: New Screen Time Guidelines for Kids. Live Science. <https://www.livescience.com/56577-screen-time-guidelines-for-kids.html>
- Blum-Ross, A. and S. Livingstone for LSE Media Policy Project (2016). Families and screen time: Current advice and emerging research. London School of Economics and Political Science. <http://blogs.lse.ac.uk/mediapolicyproject/>
- Bobbio, Antonella; Cantore, Luciana; Miranda, Nicola; Zollo, Aldo (2007). New tools for scientific learning in the EduSeis project: the e-learning experiment. *Ann. Geophys.*, 50 (2): 283-290.
- Bos, Mark J. W.; Koolstra, Cees M.; Willems, Jaap T. J. M. (2010). Early Exposures to Ecogenomics: Effects of Priming and Web Site Interactivity Among Adolescents. *Sci. Commun.*, 32 (2): 232-255. doi:10.1177/1075547009358625
- Bourbour, Maryam; Masoumi, Davoud (2017). Practise what you preach: The Interactive Whiteboard in preschool mathematics education. *Early Child Dev. Care*, 187 (11): 1819-1832. doi:10.1080/03004430.2016.1192617
- Bourgonjon, Jeroen; De Grove, Frederik; De Smet, Cindy; Van Looy, Jan; Soetaert, Ronald; Valcke, Martin (2013). Acceptance of game-based learning by secondary school teachers. *Comput. Educ.*, 67: 21-35. doi:10.1016/j.compedu.2013.02.010
- Bourgonjon, Jeroen; Valcke, Martin; Soetaert, Ronald; de Wever, Bram; Schellens, Tammy (2011). Parental acceptance of digital game-based learning. *Comput. Educ.*, 57 (1): 1434-1444. doi:10.1016/j.compedu.2010.12.012
- Brambilla, Paolo; Giussani, Marco; Pasinato, Angela; Venturelli, Leonello; Privitera, Francesco; del Giudice, Emanuele Miraglia; Sollai, Sara; Picca, Marina; Di Mauro, Giuseppe; Bruni, Oliviero; Chiappini, Elena (2017). Sleep habits and pattern in 1-14 years old children and relationship with video devices use and evening and night child activities. *Ital. J. Pediatr.*, 43: 7. doi:10.1186/s13052-016-0324-x
- Bulic, Mila; Jelaska, Igor; Jelaska, Petra Mandic (2017). The Effect of E-learning on the Acquisition of Learning Outcomes in Teaching Science and Biology. *Croat. J. Educ.*, 19 (2): 447-465. doi:10.15516/cje.v19i2.2230
- Burton, Suzanne L.; Pearsall, Aimee (2016). Music-based iPad app preferences of young children. *Res. Stud. Music Educ.*, 38 (1): 75-91. doi:10.1177/1321103X16642630
- Cai, Su; Chiang, Feng-Kuang; Sun, Yuchen; Lin, Chenglong; Lee, Joey J. (2017). Applications of augmented reality-based natural interactive learning in magnetic field instruction. *Interact. Learn. Environ.*, 25 (6): 778-791. doi:10.1080/10494820.2016.1181094

- Cai, Su; Wang, Xu; Chiang, Feng-Kuang (2014). A case study of Augmented Reality simulation system application in a chemistry course. *Comput. Hum. Behav.*, 37: 31-40. doi:10.1016/j.chb.2014.04.018
- Cakiroglu, Unal; Basibuyuk, Betul; Guler, Mustafa; Atabay, Melek; Memis, Bahar Yilmaz (2017). Gamifying an ICT course: Influences on engagement and academic performance. *Comput. Hum. Behav.*, 69: 98-107. doi:10.1016/j.chb.2016.12.018
- Calculator, Stephen N. (2014). Parents' Perceptions of Communication Patterns and Effectiveness of Use of Augmentative and Alternative Communication Systems by Their Children With Angelman Syndrome. *Am. J. Speech-Lang. Pathol.*, 23 (4): 562-573. doi:10.1044/2014_AJSLP-13-0140
- Canadian Pediatric Society; Digital Health Task Force (2017). Screen time and young children: Promoting health and development in a digital world. <https://www.cps.ca/en/documents/position/screen-time-and-young-children>
- Canadian Society for Exercise Physiology. Canadian Sedentary Behaviour Guidelines - For the Early Years 0-4 Years. <http://www.csep.ca/home>
- Cano, Maria-Dolores; Sanchez-Iborra, Ramon (2015). On the use of a multimedia platform for music education with handicapped children: A case study. *Computers & Education*, 87: 254--276.
- Caring for Kids (2017). Screen time and young children. <https://www.caringforkids.cps.ca/handouts/screen-time-and-young-children>
- Castellar, Elena Nunez; All, Anissa; de Marez, Lieven; Van Looy, Jan (2015). Cognitive abilities, digital games and arithmetic performance enhancement: A study comparing the effects of a math game and paper exercises. *Comput. Educ.*, 85: 123-133. doi:10.1016/j.compedu.2014.12.021
- Caviglia, Francesco; Delfino, Manuela (2016). Foundational skills and dispositions for learning: an experience with Information Problem Solving on the Web. *Technol. Pedagog. Educ.*, 25 (4): 487-512. doi:10.1080/1475939X.2015.1080756
- CEDA (2015). Australia's future workforce? <http://www.ceda.com.au/Research-and-policy/All-CEDA-research/Research-catalogue/Australia-s-future-workforce>.
- CEO Sydney. Tablet Use in Schools: Ergonomics, Posture and Screentime Recommendations. www.blackburnps.vic.edu.au/?media_dl=389
- Chamberlain, Elizabeth (2017). Extending the classroom walls: using academic blogging as an intervention strategy to improve critical literacy skills with elementary students. *Educ. 3-13*, 45 (2): 243-257. doi:10.1080/03004279.2015.1078831
- Chambers, Bette; Slavin, Robert E.; Madden, Nancy A.; Abrami, Philip C.; Tucker, Bradley J.; Cheung, Alan; Gifford, Richard (2008). Technology infusion in success for all: Reading outcomes for first graders. *ELEMENTARY SCHOOL JOURNAL*, 109 (1): 1--15.
- Chandra, Vinesh; Watters, James J. (2012). Re-thinking physics teaching with web-based learning. *Comput. Educ.*, 58 (1): 631-640. doi:10.1016/j.compedu.2011.09.010
- Chang, Chia-Jung; Chang, Ming-Hua; Chiu, Bing-Cheng; Liu, Chen-Chung; Chiang, Shih-Hsun Fan; Wen, Cai-Ting; Hwang, Fu-Kwun; Wu, Ying-Tien; Chao, Po-Yao; Lai, Chia-Hsi; Wu, Su-Wen; Chang, Chih-Kang; Chen, Wenli (2017). An analysis of student collaborative problem solving activities mediated by collaborative simulations. *Comput. Educ.*, 114: 222-235. doi:10.1016/j.compedu.2017.07.008
- Chang, Chia-Jung; Liu, Chen-Chung; Tsai, Chin-Chung (2016). Supporting Scientific Explanations with Drawings and Narratives on Tablet Computers: An Analysis of Explanation Patterns. *Asia-Pac. Educ. Res.*, 25 (1): 173-184. doi:10.1007/s40299-015-0247-0
- Chang, Chi-Cheng; Tseng, Kuo-Hung; Liang, Chaoyun; Yan, Chi-Fang (2013). The influence of perceived convenience and curiosity on continuance intention in mobile English learning for high school students using PDAs. *Technol. Pedagog. Educ.*, 22 (3): 373-386. doi:10.1080/1475939X.2013.802991
- Chang, Shao-Chen; Hwang, Gwo-Jen (2017). Development of an effective educational computer game based on a mission synchronization-based peer-assistance approach. *Interact. Learn. Environ.*, 25 (5): 667-681. doi:10.1080/10494820.2016.1172241

- Chao, Chih-Yang; Chen, Yuan-Tai; Chuang, Kuei-Yu (2015). Exploring students' learning attitude and achievement in flipped learning supported computer aided design curriculum: A study in high school engineering education. *Comput. Appl. Eng. Educ.*, 23 (4): 514-526. doi:10.1002/cae.21622
- Chao, Po-Yao; Lin, Chia-Ching (2015). Young children's storybook searching with a visualized search interface. *Electron. Libr.*, 33 (4): 610-624. doi:10.1108/EL-12-2013-0219
- Chastenay, Pierre (2016). From Geocentrism to Allocentrism: Teaching the Phases of the Moon in a Digital Full-Dome Planetarium. *Res. Sci. Educ.*, 46 (1): 43-77. doi:10.1007/s11165-015-9460-3
- Chebli, Sabine Saade; Lanovaz, Marc J.; Dufour, Marie-Michelle (2017). Generalization Following Tablet-Based Instruction in Children With Autism Spectrum Disorders. *Journal of Special Education Technology*, 32 (2): 70--79.
- Checa-Romero, Mirian (2016). Developing Skills in Digital Contexts: Video games and Films as Learning Tools at Primary School. *Games Cult.*, 11 (5): 463-488. doi:10.1177/1555412015569248
- Chen, Cheng-Ping; Shih, Ju-Ling; Ma, Yi-Chun (2014). Using Instructional Pervasive Game for School Children's Cultural Learning. *Educ. Technol. Soc.*, 17 (2): 169-182.
- Chen, Chia-Li Debra; Yeh, Ting-Kuang; Chang, Chun-Yen (2016). The Effects of Game-Based Learning and Anticipation of a Test on the Learning Outcomes of 10th Grade Geology Students. *Eurasia J. Math. Sci. Technol. Educ.*, 12 (5): 1379-1388.
- Chen, Chien-Hsu; Lee, I-Jui; Lin, Ling-Yi (2016). Augmented reality-based video-modeling storybook of nonverbal facial cues for children with autism spectrum disorder to improve their perceptions and judgments of facial expressions and emotions. *Comput. Hum. Behav.*, 55: 477-485. doi:10.1016/j.chb.2015.09.033
- Chen, Chih Hung; Yang, Jie Chi; Shen, Sarah; Jeng, Ming Chang (2007). A desktop virtual reality earth motion system in astronomy education. *Educ. Technol. Soc.*, 10 (3): 289-304.
- Chen, Chih-Hung; Liu, Guan-Zhi; Hwang, Gwo-Jen (2016). Interaction between gaming and multistage guiding strategies on students' field trip mobile learning performance and motivation. *Br. J. Educ. Technol.*, 47 (6): 1032-1050. doi:10.1111/bjet.12270
- Chen, Chih-Ming; Chen, Fang-Ya (2014). Enhancing digital reading performance with a collaborative reading annotation system. *Comput. Educ.*, 77: 67-81. doi:10.1016/j.compedu.2014.04.010
- Chen, Chih-Ming; Tan, Chia-Chen; Lo, Bey-Jane (2016). Facilitating English-language learners' oral reading fluency with digital pen technology. *Interact. Learn. Environ.*, 24 (1): 96-118. doi:10.1080/10494820.2013.817442
- Chen, Chih-Ming; Tsai, Yen-Nung (2012). Interactive augmented reality system for enhancing library instruction in elementary schools. *Comput. Educ.*, 59 (2): 638-652. doi:10.1016/j.compedu.2012.03.001
- Chen, Hong-Ren; Huang, Hui-Ling (2011). Learning Achievement of Knowledge Management Adaptivity in Web-based Interactive Learning Systems for a Junior High School in Taiwan. *New Educ. Rev.*, 25 (3): 183-193.
- Chen, Hong-Ren; Lin, You-Shiuan (2016). An examination of digital game-based situated learning applied to Chinese language poetry education. *Technol. Pedagog. Educ.*, 25 (2): 171-186. doi:10.1080/1475939X.2015.1007077
- Chen, Nian-Shing; Quadir, Benazir; Teng, Daniel C. (2011). Integrating book, digital content and robot for enhancing elementary school students' learning of English. *Australas. J. Educ. Technol.*, 27 (3): 546-561.
- Chen, Pin-Chang; Lan, Tian-Syung; Chiu, Shu-Chun; Lan, Yu-Hua (2014). A Study of Investigating the Learning Effectiveness of Applying the MOODLE E-Learning in Taiwan's Elementary School. *J. Internet Technol.*, 15 (7): 1191-1194. doi:10.6138/JIT.2014.15.7.13
- Chen, Tzung-Shi; Chiu, Po-Sheng; Huang, Yueh-Min; Hsieh, Wen-Jen (2016). The Effect of Context-Aware Mobile Learning on Chinese Rhetoric Ability of Elementary School Students. *J. Internet Technol.*, 17 (7): 1309-1316. doi:10.6138/JIT.2016.17.7.20131017

- Chen, Zhi-Hong; Chao, Po-Yao; Hsu, Ming-Chieh; Teng, Chin-Hung (2013). Level Up, My-Pet: The Effects of Level-up Mechanism of Educational Agents on Student Learning. *Educ. Technol. Soc.*, 16 (4): 111-121.
- Cheng, Kun-Hung; Tsai, Chin-Chung (2014). Children and parents' reading of an augmented reality picture book: Analyses of behavioral patterns and cognitive attainment. *Comput. Educ.*, 72: 302-312. doi:10.1016/j.compedu.2013.12.003
- Cheng, Kun-Hung; Tsai, Chin-Chung (2016). The interaction of child-parent shared reading with an augmented reality (AR) picture book and parents' conceptions of AR learning. *Br. J. Educ. Technol.*, 47 (1): 203-222. doi:10.1111/bjjet.12228
- Cheung, Celeste H. M.; Bedford, Rachael; De Urabain, Irati R. Saez; Karmiloff-Smith, Annette; Smith, Tim J. (2017). Daily touchscreen use in infants and toddlers is associated with reduced sleep and delayed sleep onset. *Sci Rep*, 7: 46104. doi:10.1038/srep46104
- Chiang, Tosti H. C.; Yang, Stephen J. H.; Hwang, Gwo-Jen (2014). An Augmented Reality-based Mobile Learning System to Improve Students' Learning Achievements and Motivations in Natural Science Inquiry Activities. *Educ. Technol. Soc.*, 17 (4): 352-365.
- Chiang, Tosti H. C.; Yang, Stephen J. H.; Hwang, Gwo-Jen (2014). Students' online interactive patterns in augmented reality-based inquiry activities. *Comput. Educ.*, 78: 97-108. doi:10.1016/j.compedu.2014.05.006
- Chien, Kuei-Pin; Tsai, Cheng-Yue; Chen, Hsiu-Ling; Chang, Wen-Hua; Chen, Sufen (2015). Learning differences and eye fixation patterns in virtual and physical science laboratories. *Comput. Educ.*, 82: 191-201. doi:10.1016/j.compedu.2014.11.023
- Chien, Miao-En; Jheng, Cyun-Meng; Lin, Ni-Miao; Tang, Hsien-Hui; Taelle, Paul; Tseng, Wen-Sheng; Chen, Mike Y. (2015). iCAN: A tablet-based pedagogical system for improving communication skills of children with autism. *Int. J. Hum.-Comput. Stud.*, 73: 79-90. doi:10.1016/j.ijhcs.2014.06.001
- Chitakunye, Pepukayi; Takhar, Amandeep (2014). Consuming family quality time: the role of technological devices at mealtimes. *BRITISH FOOD JOURNAL*, 116 (7): 1162--1179.
- Chmiliar, Linda (2017). Improving Learning Outcomes: The iPad and Preschool Children with Disabilities. *Front. Psychol.*, 8: 660. doi:10.3389/fpsyg.2017.00660
- Cho, Kyung-Seu; Lee, Jae-Moo (2017). Influence of smartphone addiction proneness of young children on problematic behaviors and emotional intelligence: Mediating self-assessment effects of parents using smartphones. *Comput. Hum. Behav.*, 66: 303-311. doi:10.1016/j.chb.2016.09.063
- Choi, Yong Suk (2015). Effectiveness of game based learning to minimize boolean functions. *Multimed. Tools Appl.*, 74 (17): 7131-7146. doi:10.1007/s11042-014-1956-8
- Chu, Samuel K. W.; Capio, Catherine M.; van Aalst, Jan C. W.; Cheng, Eddie W. L. (2017). Evaluating the use of a social media tool for collaborative group writing of secondary school students in Hong Kong. *Comput. Educ.*, 110: 170-180. doi:10.1016/j.compedu.2017.03.006
- Chuang, Hsueh-Hua; Weng, Chih-Yuan; Huang, Fu-Chen (2015). A structure equation model among factors of teachers' technology integration practice and their TPCK. *Comput. Educ.*, 86: 182-191. doi:10.1016/j.compedu.2015.03.016
- Chung, Liang-Yi; Chang, Rong-Chi (2017). The Effect of Gender on Motivation and Student Achievement in Digital Game-based Learning: A Case Study of a Contented-Based Classroom. *Eurasia J. Math. Sci. Technol. Educ.*, 13 (6): 2309-2327. doi:10.12973/eurasia.2017.01227a
- Ciccarelli M, Straker L, Mathiassen SE, Pollock C. (2011). ITKids part I: children's occupations and use of information and communication technologies. *Work*. 38(4):401-12. doi: 10.3233/WOR-2011-1167.
- Ciccarelli, Marina; Straker, Leon; Mathiassen, Svend Erik; Pollock, Clare (2011). ITKids Part II: Variation of postures and muscle activity in children using different information and communication technologies *Work*, 38 (4): 413-427. doi: 10.3233/WOR-2011-1168

- Ciccione, Jillian; Woodruff, Sarah J.; Fryer, Katherine; Campbell, Ty; Cole, Mary (2013). Associations among evening snacking, screen time, weight status, and overall diet quality in young adolescents. *Appl. Physiol. Nutr. Metab.*, 38 (7): 789-794. doi:10.1139/apnm-2012-0374
- Clark, Megan L. E.; Austin, David W.; Craike, Melinda J. (2015). Professional and Parental Attitudes Toward iPad Application Use in Autism Spectrum Disorder. *Focus Autism Dev. Disabil.*, 30 (3): 174-181. doi:10.1177/1088357614537353
- Clarke, Linda; Abbott, Lesley (2016). Young pupils', their teacher's and classroom assistants' experiences of iPads in a Northern Ireland school: "Four and five years old, who would have thought they could do that?". *Br. J. Educ. Technol.*, 47 (6): 1051-1064. doi:10.1111/bjet.12266
- Claro, Magdalena; Nussbaum, Miguel; Lopez, Ximena; Contardo, Victoria (2017). Differences in Views of School Principals and Teachers regarding Technology Integration. *Educ. Technol. Soc.*, 20 (3): 42-53.
- Coştu, Serkan; Aydın, Serhat; Filiz, Mehmet (2009). Students' conceptions about browser-game-based learning in mathematics education: TNetvitamin case. *Procedia - Social and Behavioral Sciences*, 1 (1): 1848--1852.
- Coles, Claire D.; Strickland, Dorothy C.; Padgett, Lynne; Bellmoff, Lynnae (2007). Games that "work": Using computer games to teach alcohol-affected children about fire and street safety. *Res. Dev. Disabil.*, 28 (5): 518-530. doi:10.1016/j.ridd.2006.07.001
- Connell, Sabrina L.; Lauricella, Alexis R.; Wartella, Ellen (2015). Parental Co-use of Media Technology with their Young Children in the USA. *J. Child. Media*, 9 (1): 5-21. doi:10.1080/17482798.2015.997440
- Couse, Leslie J.; Chen, Dora W. (2010). A Tablet Computer for Young Children? Exploring Its Viability for Early Childhood Education. *Journal of Research on Technology in Education*, 43 (1): 75--98.
- Coutinho, Franzina; Bosisio, Marie-Elaine; Brown, Emma; Rishikof, Stephanie; Skaf, Elise; Zhang, Xiaoting; Perlman, Cynthia; Kelly, Shannon; Freedin, Erin; Dahan-Oliel, Noemi (2017). Effectiveness of iPad apps on visual-motor skills among children with special needs between 4y0m-7y11m. *Disability and Rehabilitation-Assistive Technology*, 12 (4): 402--410.
- Craig, Ashley B.; Brown, Emily R.; Upright, James; DeRosier, Melissa E. (2016). Enhancing Children's Social Emotional Functioning Through Virtual Game-Based Delivery of Social Skills Training. *J. Child Fam. Stud.*, 25 (3): 959-968. doi:10.1007/s10826-015-0274-8
- Cristia, Alejandrina; Seidl, Amanda (2015). Parental Reports on Touch Screen Use in Early Childhood. *PLoS One*, 10 (6): e0128338. doi:10.1371/journal.pone.0128338
- Crook, Simon J.; Sharma, Manjula D.; Wilson, Rachel (2015). An Evaluation of the Impact of 1:1 Laptops on Student Attainment in Senior High School Sciences. *Int. J. Sci. Educ.*, 37 (2): 272-293. doi:10.1080/09500693.2014.982229
- Cushing, Anna; Manice, Melissa P.; Ting, Andrew; Parides, Michael K. (2016). Feasibility of a novel mHealth management system to capture and improve medication adherence among adolescents with asthma. *Patient Preference and Adherence*, 10: 2271--2275.
- D'Agostino, Jerome V.; Rodgers, Emily; Harmey, Sinead; Brownfield, Katherine (2016). Introducing an iPad app into literacy instruction for struggling readers: Teacher perceptions and student outcomes. *J. Early Child. Lit.*, 16 (4): 522-548. doi:10.1177/1468798415616853
- Dai, Chien-Yun; Huang, Duen-Huang (2015). Causal complexities to evaluate the effectiveness of remedial instruction. *J. Bus. Res.*, 68 (4): 894-899. doi:10.1016/j.jbusres.2014.11.048
- Dalton, Bridget; Proctor, C. Patrick; Uccelli, Paola; Mo, Elaine; Snow, Catherine E. (2011). Designing for Diversity: The Role of Reading Strategies and Interactive Vocabulary in a Digital Reading Environment for Fifth-Grade Monolingual English and Bilingual Students. *J. Lit. Res.*, 43 (1): 68-100. doi:10.1177/1086296X10397872
- Dalton, Gene; Devitt, Ann (2016). Gaeilge Gaming: Assessing how games can help children to learn Irish. *Int. J. Game-Based Learn.*, 6 (4): 22-38. doi:10.4018/IJGBL.2016100102
- Dandashi, Amal; Karkar, Abdel Ghani; Saad, Sawsan; Barhoumi, Zaara; Al-Jaam, Jihad; El Saddik, Abdulmotaleb (2015). Enhancing the Cognitive and Learning Skills of Children with Intellectual

- Disability through Physical Activity and Edutainment Games. *International Journal of Distributed Sensor Networks*.
- Daubenmire, Patrick L.; van Opstal, Mary T.; Hall, Natalie J.; Wunar, Bryan; Kowrach, Nicole (2017). Using the chemistry classroom as the starting point for engaging urban high school students and their families in pro-environmental behaviors. *International Journal of Science Education Part B: Communication and Public Engagement*, 7 (1): 60--75.
- Davies, C. (2011). Digitally strategic: how young people respond to parental views about the use of technology for learning in the home. *J. Comput. Assist. Learn.*, 27 (4): 324-335.
doi:10.1111/j.1365-2729.2011.00427.x
- de Castro, Marcus Vasconcelos; Silva Bissaco, Marcia Aparecida; Pancioni, Bruno Marques; Martini Rodrigues, Silvia Cristina; Domingues, Andreia Miranda (2014). Effect of a Virtual Environment on the Development of Mathematical Skills in Children with Dyscalculia. *PLoS One*, 9 (7): e103354.
doi:10.1371/journal.pone.0103354
- de Souza, Bruno Campello; de Lima e Silva, Leonardo Xavier; Roazzi, Antonio (2010). MMORPGS and cognitive performance: A study with 1280 Brazilian high school students. *Comput. Hum. Behav.*, 26 (6): 1564-1573. doi:10.1016/j.chb.2010.06.001
- Department of Education (Government of Queensland). (2015) Physical activity in state schools.
<http://education.qld.gov.au/schools/healthy/wellbeing-guidelines/physical-activity.html>
- Department of Education and Training (Government of Queensland) (2015). Screen time and children - Tip Sheet for Parents.
<https://det.qld.gov.au/earlychildhood/family/Documents/pdf/pts-screen-time-and-children.pdf>
- Department of Education and Training (Government of Western Australia) (2015). Learning at home.
<https://www.education.wa.edu.au/documents/1788166/0/LEARNING+AT+HOME+BOOKLET+2017/9196cf9d-0b9f-498b-8aae-2e22a8a80c6b>
- Department of Health (Australian Government) (2012). Inactivity and screen time.
<http://www.health.gov.au/internet/publications/publishing.nsf/Content/gug-indig-hb~inactivitiy>
- Department of Health (Government of Western Australia). Screen time.
http://healthywa.wa.gov.au/Articles/S_T/Screen-time
- Department of Health and Aging (Australian Government) (2009). Get Up & Grow.
[http://www.health.gov.au/internet/main/publishing.nsf/content/2CDB3A000FE57A4ECA257BF0001916EC/\\$File/HEPA%20-%20B5%20Book%20-%20Staff%20and%20Carer%20Book_LR.pdf](http://www.health.gov.au/internet/main/publishing.nsf/content/2CDB3A000FE57A4ECA257BF0001916EC/$File/HEPA%20-%20B5%20Book%20-%20Staff%20and%20Carer%20Book_LR.pdf)
- Department of Health and Aging (Australian Government) (2010). Move and Play Every day - National physical activity recommendations for children 0-5 years. www.healthyactive.gov.au
- Desai, Tania; Chow, Katherine; Mumford, Leslie; Hotze, Fanny; Chau, Tom (2014). Implementing an iPad-based alternative communication device for a student with cerebral palsy and autism in the classroom via an access technology delivery protocol. *Computers & Education*, 79: 148--158.
- Diaz, Maria A (2016). Digital Storytelling with Pre-service Teachers. *Raising Awareness for Refugees Through ICTs in ESL Primary Classes. Digital Education.*, 30: 1-16.
- Di Giacomo, Dina; Ranieri, Jessica; Lacasa, Pilar (2017). Digital Learning As Enhanced Learning Processing? Cognitive Evidence for New insight of Smart Learning. *Front. Psychol.*, 8: 1329.
doi:10.3389/fpsyg.2017.01329
- Didehbani, Nyaz; Allen, Tandra; Kandalaf, Michelle; Krawczyk, Daniel; Chapman, Sandra (2016). Virtual Reality Social Cognition Training for children with high functioning autism. *Comput. Hum. Behav.*, 62: 703-711. doi:10.1016/j.chb.2016.04.033
- Dinleyici, Meltem; Carman, Kursat Bora; Ozturk, Emel; Sahin-Dagli, Figen (2016). Media Use by Children, and Parents' Views on Children's Media Usage. *Interact. J. Med. Res.*, 5 (2): 23-32.
doi:10.2196/ijmr.5668
- Dinleyici, Meltem; Carman, Kursat Bora; Ozturk, Emel; Sahin-Dagli, Figen (2016). Media Use by Children, and Parents' Views on Children's Media Usage. *Interact. J. Med. Res.*, 5 (2): 23-32.
doi:10.2196/ijmr.5668

- Ditzler, Christine; Hong, Eunsook; Strudler, Neal (2016). How Tablets Are Utilized in the Classroom. *J. Res. Technol. Educ.*, 48 (3): 181-193. doi:10.1080/15391523.2016.1172444
- Dolenc, Kosta; Abersek, Boris (2015). TECH8 intelligent and adaptive e-learning system: Integration into Technology and Science classrooms in lower secondary schools. *Comput. Educ.*, 82: 354-365. doi:10.1016/j.compedu.2014.12.010
- Domingues-Montanari, S. (2017). Clinical and psychological effects of excessive screen time on children. *J Paediatr Child Health*, 53: 333–338. doi:10.1111/jpc.13462
- Doyle, Theresa |; Arnedillo-Sanchez, Inrnaculada (2011). Using multimedia to reveal the hidden code of everyday behaviour to children with autistic spectrum disorders (ASDs). *Computers & Education*, 56 (2): 357--369.
- Duh, Emilija Stojmenova; Koceska, Natasa; Koceski, Saso (2017). Game-based learning: educational game Azbuka to help young children learn writing Cyrillic letters. *Multimed. Tools Appl.*, 76 (12): 14091-14105. doi:10.1007/s11042-016-3829-9
- Duijzer, Carolien A. C. G.; Shayan, Shakila; Bakker, Arthur; Van der Schaaf, Marieke F.; Abrahamson, Dor (2017). Touchscreen Tablets: Coordinating Action and Perception for Mathematical Cognition. *Front. Psychol.*, 8: 144. doi:10.3389/fpsyg.2017.00144
- Duncan, Lynne G.; McGeown, Sarah P.; Griffiths, Yvonne M.; Stothard, Susan E.; Dobai, Anna (2016). Adolescent reading skill and engagement with digital and traditional literacies as predictors of reading comprehension. *Br. J. Psychol.*, 107 (2): 209-238. doi:10.1111/bjop.12134
- Dundar, Hakan; Akcayir, Murat (2014). Implementing tablet PCs in schools: Students' attitudes and opinions. *Comput. Hum. Behav.*, 32: 40-46. doi:10.1016/j.chb.2013.11.020
- Dunleavy, Matt; Dede, Chris; Mitchell, Rebecca (2009). Affordances and Limitations of Immersive Participatory Augmented Reality Simulations for Teaching and Learning. *J. Sci. Educ. Technol.*, 18 (1): 7-22. doi:10.1007/s10956-008-9119-1
- Duran, Muharrem; Aytac, Tufan (2016). Students' Opinions on the Use of Tablet Computers in Education. *Eur. J. Contermp. Educ.*, 15 (1): 65-75. doi:10.13187/ejced.2016.15.65
- Early Childhood Australia (2013). Young children and screen time. <http://www.earlychildhoodaustralia.org.au>
- Ebbeck, Marjory; Yim, Hoi Yin Bonnie; Chan, Yvonne; Goh, Mandy (2016). Singaporean Parents' Views of Their Young Children's Access and Use of Technological Devices. *Early Child. Educ. J.*, 44 (2): 127-134. doi:10.1007/s10643-015-0695-4
- Ebbeck, Marjory; Yim, Hoi Yin Bonnie; Chan, Yvonne; Goh, Mandy (2016). Singaporean Parents' Views of Their Young Children's Access and Use of Technological Devices. *Early Child. Educ. J.*, 44 (2): 127-134. doi:10.1007/s10643-015-0695-4
- Ebrahimzadeh, Mohsen; Alavi, Sepideh (2016). Motivating EFL students: E-learning enjoyment as a predictor of vocabulary learning through digital video games. *Cogent Educ.*, 3: UNSP 1255400. doi:10.1080/2331186X.2016.1255400
- Ehmke R. (2017). Media Guidelines for Kids of All Ages - Tips for Making sure your children's screen time is healthy. Child Mind Institute. <https://childmind.org/article/media-guidelines-for-kids-of-all-ages/>
- Eisen, Sierra; Lillard, Angeline S. (2016). Just Google It: Young Children's Preferences for Touchscreens versus Books in Hypothetical Learning Tasks. *Front. Psychol.*, 7: 1431. doi:10.3389/fpsyg.2016.01431
- Ekeh, Akpofure Peter; Herman, Kyle; Bayham, Dustin; Markert, Ronald; Pedoto, Michael; McCarthy, Mary C. (2013). Pilot evaluation of the short-term effect of driving simulation on novice adolescent drivers. *J. Trauma Acute Care Surg.*, 75 (1): 83-86. doi:10.1097/TA.0b013e3182988a51
- Ellis, Kirsten; Blashki, Kathy (2007). The Digital Playground: Kindergarten Children Learning Sign Language Through Multimedia. *AACE Journal*, 15 (3): 225--253.
- Ellis, R. A.; Goodyear, P.; Bliuc, A. -M.; Ellis, M. (2011). High school students' experiences of learning through research on the Internet. *J. Comput. Assist. Learn.*, 27 (6): 503-515. doi:10.1111/j.1365-2729.2011.00412.x

- Escobedo, Lizbeth; Tentori, Monica; Quintana, Eduardo; Favela, Jesus; Garcia-Rosas, Daniel (2014). Using Augmented Reality to Help Children with Autism Stay Focused. *IEEE Pervasive Comput.*, 13 (1): 38-46. doi:10.1109/MPRV.2014.19
- Falbe, Jennifer; Davison, Kirsten K.; Franckle, Rebecca L.; Ganter, Claudia; Gortmaker, Steven L.; Smith, Lauren; Land, Thomas; Taveras, Elsie M. (2015). Sleep Duration, Restfulness, and Screens in the Sleep Environment. *Pediatrics*, 135 (2): E367-E375. doi:10.1542/peds.2014-2306
- Falbe, Jennifer; Rosner, Bernard; Willett, Walter C.; Sonnevile, Kendrin R.; Hu, Frank B.; Field, Alison E. (2013). Adiposity and Different Types of Screen Time. *Pediatrics*, 132 (6): E1497-E1505. doi:10.1542/peds.2013-0887
- Falbe, Jennifer; Willett, Walter C.; Rosner, Bernard; Gortmaker, Steve L.; Sonnevile, Kendrin R.; Field, Alison E. (2014). Longitudinal relations of television, electronic games, and digital versatile discs with changes in diet in adolescents. *Am. J. Clin. Nutr.*, 100 (4): 1173-1181. doi:10.3945/ajcn.114.088500
- Falloon, G. (2016). An analysis of young students' thinking when completing basic coding tasks using Scratch Jnr. On the iPad. *J. Comput. Assist. Learn.*, 32 (6): 576-593. doi:10.1111/jcal.12155
- Fassnacht, Daniel B.; Ali, Kathina; Silva, Catia; Goncalves, Sonia; Machado, Paulo P. P. (2015). Use of Text Messaging Services to Promote Health Behaviors in Children. *Journal of Nutrition Education & Behavior*, 47 (1): 75--80.
- Fedele, David A.; Cushing, Christopher C.; Fritz, Alyssa; Amaro, Christina M.; Ortega, Adrian (2017). Mobile Health Interventions for Improving Health Outcomes in Youth A Meta-analysis. *JAMA Pediatr.*, 171 (5): 461-469. doi:10.1001/jamapediatrics.2017.0042
- Fernandez-Molina, Milagros; Trella, Monica; Barros, Beatriz (2015). Experiences with tasks supported by a cognitive e-learning system in preschool: Modelling and training on working memory and attentional control. *Int. J. Hum.-Comput. Stud.*, 75: 35-51. doi:10.1016/j.ijhcs.2014.11.001
- Fernandez-Montalvo, Javier; Penalva, Alicia; Irazabal, Itziar; Lopez-Goni, Jose J. (2017). Effectiveness of a digital literacy programme for primary education students. *Cult. Educ.*, 29 (1): 1-30. doi:10.1080/11356405.2016.1269501
- Ferrari, Laura; Addressi, Anna Rita (2014). A new way to play music together: The Continuator in the classroom. *Int. J. Music Educ.*, 32 (2): 171-184. doi:10.1177/0255761413504706
- Fesel, Sabine S.; Segers, Eliane; Clariana, Roy B.; Verhoeven, Ludo (2015). Quality of children's knowledge representations in digital text comprehension: Evidence from pathfinder networks. *Comput. Hum. Behav.*, 48: 135-146. doi:10.1016/j.chb.2015.01.014
- Finkelstein, Samantha; Nickel, Andrea; Lipps, Zachary; Barnes, Tiffany; Wartell, Zachary; Suma, Evan A. (2011). Astrojumper: Motivating Exercise with an Immersive Virtual Reality Exergame. *Presence-Teleoper. Virtual Env.*, 20 (1): 78-92.
- Fleer, Marilyn (2017). Digital Role-Play: The Changing Conditions of Children's Play in Preschool Settings. *Mind Cult. Act.*, 24 (1): 3-17. doi:10.1080/10749039.2016.1247456
- Fletcher-Watson, Sue; Petrou, Alexandra; Scott-Barrett, Juliet; Dicks, Pamela; Graham, Catherine; O'Hare, Anne; Pain, Helen; McConachie, Helen (2016). A trial of an iPad intervention targeting social communication skills in children with autism. *Autism*, 20 (7): 771-782. doi:10.1177/1362361315605624
- Flewitt, Rosie; Messer, David; Kucirkova, Natalia (2015). New directions for early literacy in a digital age: The iPad. *J. Early Child. Lit.*, 15 (3): 289-310. doi:10.1177/1468798414533560
- Fobian, Aaron D.; Avis, Kristin; Schwebel, David C. (2016). Impact of Media Use on Adolescent Sleep Efficiency. *Journal of Developmental and Behavioral Pediatrics*, 37 (1): 9--14.
- Foessel, Thomas; Ebner, Martin; Schoen, Sandra; Holzinger, Andreas (2016). A Field Study of a Video Supported Seamless-Learning-Setting with Elementary Learners. *Educ. Technol. Soc.*, 19 (1): 321-336.

- Freeman, Barbara (2012). Using digital technologies to redress inequities for English language learners in the English speaking mathematics classroom. *Comput. Educ.*, 59 (1): 50-62. doi:10.1016/j.compedu.2011.11.003
- Froiland, Dag Helge; Arsand, Eirik; Skarderud, Finn (2012). Improving Diabetes Care for Young People With Type 1 Diabetes Through Visual Learning on Mobile Phones: Mixed-Methods Study. *Journal of Medical Internet Research*, 14 (4): 113--125.
- Furio, D.; Juan, M. -C.; Segui, I.; Vivo, R. (2015). Mobile learning vs. traditional classroom lessons: a comparative study. *J. Comput. Assist. Learn.*, 31 (3): 189-201. doi:10.1111/jcal.12071
- Furio, David; Gonzalez-Gancedo, Santiago; Juan, M. -Carmen; Segui, Ignacio; Rando, Noemi (2013). Evaluation of learning outcomes using an educational iPhone game vs. traditional game. *Comput. Educ.*, 64: 1-23. doi:10.1016/j.compedu.2012.12.001
- Ganz, Jennifer B.; Boles, Margot B.; Goodwyn, Fara D.; Flores, Margaret M. (2014). Efficacy of Handheld Electronic Visual Supports to Enhance Vocabulary in Children With ASD. *Focus Autism Dev. Disabil.*, 29 (1): 3-12. doi:10.1177/1088357613504991
- Gao, Zan; Lee, Jung Eun; Pope, Zachary; Zhang, Dachao (2016). Effect of Active Videogames on Underserved Children's Classroom Behaviors, Effort, and Fitness. *Games Health J.*, 5 (5): 318-324. doi:10.1089/g4h.2016.0049
- Gao, Zan; Pope, Zachary; Lee, Jung Eun; Stodden, David; Roncesvalles, Nida; Pasco, Denis; Huang, Charles C.; Feng, Du (2017). Impact of exergaming on young children's school day energy expenditure and moderate-to-vigorous physical activity levels. *J. Sport Health Sci.*, 6 (1): 11-16. doi:10.1016/j.jshs.2016.11.008
- Garcia-Martin, Judit; Garcia-Sanchez, Jesus-Nicasio (2017). Pre-service teachers' perceptions of the competence dimensions of digital literacy and of psychological and educational measures. *Comput. Educ.*, 107: 54-67. doi:10.1016/j.compedu.2016.12.010
- Gelbart, Hadas; Brill, Gilat; Yarden, Anat (2009). The Impact of a Web-Based Research Simulation in Bioinformatics on Students' Understanding of Genetics. *Res. Sci. Educ.*, 39 (5): 725-751. doi:10.1007/s11165-008-9101-1
- Genc, Zulfu; Aydemir, Emrah (2015). An alternative evaluation: online puzzle as a course-end activity. *Interact. Technol. Smart Educ.*, 12 (3): 169-182. doi:10.1108/ITSE-04-2015-0008
- Gentile, Douglas A.; Anderson, Craig A.; Yukawa, Shintaro; Ichori, Nobuko; Saleem, Muniba; Lim Kam Ming; Shibuya, Akiko; Liao, Albert K.; Khoo, Angeline; Bushman, Brad J.; Rowell Huesmann, L.; Sakamoto, Akira (2009). The Effects of Prosocial Video Games on Prosocial Behaviors: International Evidence From Correlational, Longitudinal, and Experimental Studies. *Personality and Social Psychology Bulletin*, 35 (6): 752--763.
- Gerth, Sabrina; Klassert, Annegret; Dolk, Thomas; Fliesser, Michael; Fischer, Martin H.; Nottbusch, Guido; Festman, Julia (2016). Is Handwriting Performance Affected by the Writing Surface? Comparing Preschoolers', Second Graders', and Adults' Writing Performance on a Tablet vs. Paper. *Front. Psychol.*, 7: 1308. doi:10.3389/fpsyg.2016.01308
- Gibbs, Beatrice; Quennerstedt, Mikael; Larsson, Hakan (2017). Teaching dance in physical education using exergames. *Eur. Phys. Educ. Rev.*, 23 (2): 237-256. doi:10.1177/1356336X16645611
- Gillen, J.; Littleton, K.; Twiner, A.; Staarman, J. K.; Mercer, N. (2008). Using the interactive whiteboard to resource continuity and support multimodal teaching in a primary science classroom. *Journal of Computer Assisted Learning*, 24 (4): 348--358.
- Given, Lisa M.; Winkler, Denise Cantrell; Willson, Rebekah; Davidson, Christina; Danby, Susan; Thorpe, Karen (2016). Watching young children "play" with information technology: Everyday life information seeking in the home. *Libr. Infor. Sci. Res.*, 38 (4): 344-352. doi:10.1016/j.lisr.2016.11.007
- Gonzalez, Carina S.; Gomez, Nazaret; Navarro, Vicente; Cairos, Mariana; Quirce, Carmela; Toledo, Pedro; Marrero-Gordillo, Norberto (2016). Learning healthy lifestyles through active videogames, motor games and the gamification of educational activities. *Comput. Hum. Behav.*, 55: 529-551. doi:10.1016/j.chb.2015.08.052

- Gopalan, Valarmathie; Zulkifli, Abdul Nasir; Mohamed, Nur Fadziana Faisal; Alwi, Asmidah; Mat, Ruzinoor Che; Abu Bakar, Juliana Aida; Saidin, Aeni Zuhana (2015). Evaluation of E-Star: An Enhanced Science Textbook Using Augmented Reality Among Lower Secondary School Students. *J. Teknol.*, 77 (29).
- Greer, Mary; Lin, Lijia; Atkinson, Robert K. (2017). Using a computer game to teach school-aged children about asthma. *Interact. Learn. Environ.*, 25 (4): 431-438.
doi:10.1080/10494820.2015.1135469
- Guerra, Ernesto; Mellado, Guido (2017). A-Book: A Feedback-Based Adaptive System to Enhance Meta-Cognitive Skills during Reading. *Front. Hum. Neurosci.*, 11: 98.
doi:10.3389/fnhum.2017.00098
- Guldborg, Karen; Parsons, Sarah; Porayska-Pomsta, Kaska; Keay-Bright, Wendy (2017). Challenging the knowledge-transfer orthodoxy: Knowledge co-construction in technology-enhanced learning for children with autism. *Br. Educ. Res. J.*, 43 (2): 394-413. doi:10.1002/berj.3275
- Gun, Ezgi Tosik; Atasoy, Bilal (2017). The Effects of Augmented Reality on Elementary School Students' Spatial Ability and Academic Achievement. *Egit. Bilim*, 42 (191): 31-51.
doi:10.15390/EB.2017.7140
- Gurung, Binod; Rutledge, David (2014). Digital learners and the overlapping of their personal and educational digital engagement. *Comput. Educ.*, 77: 91-100. doi:10.1016/j.compedu.2014.04.012
- Haake, Magnus; Axelsson, Anton; Clausen-Bruun, Mette; Gulz, Agneta (2015). Scaffolding mentalizing via a play-&-learn game for preschoolers. *Comput. Educ.*, 90: 13-23.
doi:10.1016/j.compedu.2015.09.003
- Habgood, M. P. Jacob; Ainsworth, Shaaron E. (2011). Motivating Children to Learn Effectively: Exploring the Value of Intrinsic Integration in Educational Games. *J. Learn. Sci.*, 20 (2): 169-206.
doi:10.1080/10508406.2010.508029
- Hammond, James; Cherrett, Tom; Waterson, Ben (2015). Making in-class skills training more effective: The scope for interactive videos to complement the delivery of practical pedestrian training. *British Journal of Educational Technology*, 46 (6): 1344--1353.
- Hansen, Nina; Koudenburg, Namkje; Hiersemann, Rena; Tellegen, Peter J.; Kocsev, Marton; Postmes, Tom (2012). Laptop usage affects abstract reasoning of children in the developing world. *Comput. Educ.*, 59 (3): 989-1000. doi:10.1016/j.compedu.2012.04.013
- Harbard, Emily; Allen, Nicholas B.; Trinder, John; Bei, Bei (2016). What's Keeping Teenagers Up? Prebedtime Behaviors and Actigraphy-Assessed Sleep Over School and Vacation. *J. Adolesc. Health*, 58 (4): 426-432. doi:10.1016/j.jadohealth.2015.12.011
- Harlow, Ann; Cowie, Bronwen; Heazlewood, Megan (2010). Keeping in touch with learning: the use of an interactive whiteboard in the junior school. *Technol. Pedagog. Educ.*, 19 (2): 237-243.
doi:10.1080/1475939X.2010.491234
- Harrell, Michelle H.; Kotecki, Emily (2015). The Flipped Museum: Leveraging Technology to Deepen Learning. *J. Museum Education*, 40 (2): 119-130.
- Hartwell-Walker, M. (2017). Guidelines for Managing Kids' Screen Time. Psych Central.
<https://psychcentral.com/lib/guidelines-for-managing-kids-screen-time/>
- Hashemi, Sylvana Sofkova; Cederlund, Katarina (2017). Making room for the transformation of literacy instruction in the digital classroom. *J. Early Child. Lit.*, 17 (2): 221-253.
doi:10.1177/1468798416630779
- Hastie, Megan; Chen, Nian-Shing; Kuo, Yen-Hung (2007). Instructional design for best practice in the synchronous cyber classroom. *Educ. Technol. Soc.*, 10 (4): 281-294.
- Haydon, Todd; Hawkins, Renee; Denune, Hillary; Kimener, Lauren; McCoy, Dacia; Basham, James (2012). A Comparison of iPads and Worksheets on Math Skills of High School Students with Emotional Disturbance. *Behav. Disord.*, 37 (4): 232-243.
- Healthy Kids (2017). Switch off the Screen and Get Active. www.healthykids.nsw.gov.au
- Heart Foundation. Sitting Less for Children.
<https://www.heartfoundation.org.au/images/uploads/.../PA-Sitting-Less-Child.pdf>

- Heid M (2016). What the New Screen Time Guidelines For Kids Really Mean. Time.
<http://time.com/4541118/screen-time-guidelines-kids-parenting/>
- Hieftje, Kimberly; Pendergrass, Tyra; Kyriakides, Tassos C.; Gilliam, Walter; Fiellin, Lynn (2017). An Evaluation of an Educational Video Game on Mathematics Achievement in First Grade Students. *Technologies*, 5 (2): 30. doi:10.3390/technologies5020030
- Hill, Valerie (2015). Digital citizenship through game design in Minecraft. *New Lib. World*, 116 (42954): 369-382. doi:10.1108/NLW-09-2014-0112
- Hillier, Ashleigh; Greher, Gena; Queenan, Alexa; Marshall, Savannah; Kopec, Justin (2016). Music, technology and adolescents with autism spectrum disorders: The effectiveness of the touch screen interface. *Music Educ. Res.*, 18 (3): 269-282. doi:10.1080/14613808.2015.1077802
- Hinkley Trina, Cliff Dylan P., Okely Anthony D. (2015). Reducing electronic media use in 2–3 year-old children: feasibility and efficacy of the Family@play pilot randomised controlled trial. *BMC Public Health*. 15:779. doi.org/10.1186/s12889-015-2126-2"
- Hirsh-Pasek, K., Zosh, J.M., Golinkoff, R.M., Gray, J.H., Robb, M.B., & Kaufman, J. (2015). Putting education in 'educational' apps: Lessons from the science of learning. *Psychological Science in the Public Interest*, 16(1), 3-34. doi:10.1177/1529100615569721.
- Ho, Pei-Chi (2012). Influences on children's visual cognition capabilities through playing 'intelligent matrix' developed by the augmented virtual reality technology. *Journal of Humanities & Arts Computing: A Journal of Digital Humanities*, 6 (42767): 160--171.
- Ho, Shirley S.; Lwin, May O.; Sng, Jeremy R. H.; Yee, Andrew Z. H. (2017). Escaping through exergames: Presence, enjoyment, and mood experience in predicting children's attitude toward exergames. *Comput. Hum. Behav.*, 72: 381-389. doi:10.1016/j.chb.2017.03.001
- Ho, Tracy Kwei-Liang; Lin, Huann-Shyang (2015). A web-based painting tool for enhancing student attitudes toward learning art creation. *Comput. Educ.*, 89: 32-41. doi:10.1016/j.compedu.2015.08.015
- Homer, Bruce D.; Kinzer, Charles K.; Plass, Jan L.; Letourneau, Susan M.; Hoffman, Dan; Bromley, Meagan; Hayward, Elizabeth O.; Turkay, Selen; Kornak, Yolanta (2014). Moved to learn: The effects of interactivity in a Kinect-based literacy game for beginning readers. *Comput. Educ.*, 74: 37-49. doi:10.1016/j.compedu.2014.01.007
- Hong, J-C.; Cheng, C-L.; Hwang, M-Y.; Lee, C-K.; Chang, H-Y. (2009). Assessing the educational values of digital games. *J. Comput. Assist. Learn.*, 25 (5): 423-437. doi:10.1111/j.1365-2729.2009.00319.x
- Hong, Jon-Chao; Hwang, Ming-Yueh; Chen, Yu-Ju; Lin, Pei-Hsin; Huang, Yao-Tien; Cheng, Hao-Yueh; Lee, Chih-Chin (2013). Using the saliency-based model to design a digital archaeological game to motivate players' intention to visit the digital archives of Taiwan's natural science museum. *Comput. Educ.*, 66: 74-82. doi:10.1016/j.compedu.2013.02.007
- Hong, Jon-Chao; Hwang, Ming-Yueh; Tai, Kai-Hsin; Lin, Pei-Hsin (2017). Intrinsic motivation of Chinese learning in predicting online learning self-efficacy and flow experience relevant to students' learning progress. *Comput. Assist. Lang. Learn.*, 30 (6): 552-574. doi:10.1080/09588221.2017.1329215
- Hong, Jon-Chao; Tsai, Chih-Min; Ho, Ya-Jiuan; Hwang, Ming-Yueh; Wu, Ching-Ji (2013). A comparative study of the learning effectiveness of a blended and embodied interactive video game for kindergarten students. *Interact. Learn. Environ.*, 21 (1): 39-53. doi:10.1080/10494820.2010.542760
- Hopkins, Liza; Wadley, Greg; Vetere, Frank; Fong, Maria; Green, Julie (2014). Utilising technology to connect the hospital and the classroom: Maintaining connections using tablet computers and a 'Presence' App. *Australian Journal of Education*, 58 (3): 278--296.
- Horzum, Mehmet Baris; Ozturk, Ergun; Bektas, Mustafa; Gungoren, Ozlem Canan; Cakir, Ozlem (2014). Secondary School Students Tablet Computer Acceptance and Readiness: A Structural Equation Modelling. *Egit. Bilim*, 39 (176): 81-93.

- Howie EK, Campbell AC, Straker LM. (2016). An active video game intervention does not improve physical activity and sedentary time of children at-risk for developmental coordination disorder: a crossover randomized trial. *Child Care Health Dev.* 42(2):253-60. doi: 10.1111/cch.12305.
- Howie, Erin K.; Coenen, Pieter; Campbell, Amity C.; Ranelli, Sonia; Straker, Leon M. (2017). Head, trunk and arm posture amplitude and variation, muscle activity, sedentariness and physical activity of 3 to 5 year-old children during tablet computer use compared to television watching and toy play. *Appl. Ergon.*, 65: 41-50. doi:10.1016/j.apergo.2017.05.011
- Hsiao, H-S.; Chang, C-S.; Lin, C-Y.; Hu, P-M. (2014). Development of children's creativity and manual skills within digital game-based learning environment. *J. Comput. Assist. Learn.*, 30 (4): 377-395. doi:10.1111/jcal.12057
- Hsiao, Hsien-Sheng; Chang, Cheng-Sian; Lin, Chien-Yu; Chang, Chih-Chun; Chen, Jyun-Chen (2014). The influence of collaborative learning games within different devices on student's learning performance and behaviours. *Australas. J. Educ. Technol.*, 30 (6): 652-669.
- Hsiao, Hsien-Sheng; Chang, Cheng-Sian; Lin, Chien-Yu; Hsu, Hsiu-Ling (2015). iRobiQ: the influence of bidirectional interaction on kindergarteners' reading motivation, literacy, and behavior. *Interact. Learn. Environ.*, 23 (3): 269-292. doi:10.1080/10494820.2012.745435
- Hsiao, Hsien-Sheng; Chen, Jyun-Chen (2016). Using a gesture interactive game-based learning approach to improve preschool children's learning performance and motor skills. *Comput. Educ.*, 95: 151-162. doi:10.1016/j.compedu.2016.01.005
- Hsiao, Kuo-Lun; Chen, Chia-Chen (2015). How do we inspire children to learn with e-readers? *Libr. Hi Tech*, 33 (4): 584-596. doi:10.1108/LHT-04-2015-0038
- Hsiao, Kuo-Lun; Chen, Chia-Chen (2015). How do we inspire children to learn with e-readers? *Libr. Hi Tech*, 33 (4): 584-596. doi:10.1108/LHT-04-2015-0038
- Hsieh, Ya-Hui; Lin, Yi-Chun; Hou, Huei-Tse (2016). Exploring the role of flow experience, learning performance and potential behavior clusters in elementary students' game-based learning. *Interact. Learn. Environ.*, 24 (1): 178-193. doi:10.1080/10494820.2013.834827
- Hsu, Tien-Yu; Liang, Hsin-Yi (2017). A cyclical learning model to promote children's online and on-site museum learning. *Electron. Libr.*, 35 (2): 333-347. doi:10.1108/EL-01-2016-0021
- Huang, Chester S. J.; Su, Addison Y. S.; Yang, Stephen J. H.; Liou, Hsin-Hun (2017). A collaborative digital pen learning approach to improving students' learning achievement and motivation in mathematics courses. *Comput. Educ.*, 107: 31-44. doi:10.1016/j.compedu.2016.12.014
- Huang, Yueh-Min; Liang, Tsung-Ho; Chiu, Chiung-Hui (2013). Gender Differences in the Reading of E-books: Investigating Children's Attitudes, Reading Behaviors and Outcomes. *Educ. Technol. Soc.*, 16 (4): 97-110.
- Huber, Brittany; Tarasuik, Joanne; Antoniou, Mariana N.; Garrett, Chelsea; Bowe, Steven J.; Kaufman, Jordy (2016). Young children's transfer of learning from a touchscreen device. *Comput. Hum. Behav.*, 56: 56-64. doi:10.1016/j.chb.2015.11.010
- Hung, Cheng-Yu; Kuo, Fang-O.; Sun, Jerry Chih-Yuan; Yu, Pao-Ta (2014). An Interactive Game Approach for Improving Students' Learning Performance in Multi-Touch Game-Based Learning. *IEEE Trans. Learn. Technol.*, 7 (1): 31-37. doi:10.1109/TLT.2013.2294806
- Hung, Chun-Ming; Hwang, Gwo-Jen; Huang, Iwen (2012). A Project-based Digital Storytelling Approach for Improving Students' Learning Motivation, Problem-Solving Competence and Learning Achievement. *Educ. Technol. Soc.*, 15 (4): 368-379.
- Hung, Y. -H.; Chen, C. -H.; Huang, S. -W. (2017). Applying augmented reality to enhance learning: a study of different teaching materials. *J. Comput. Assist. Learn.*, 33 (3): 252-266. doi:10.1111/jcal.12173
- Hutchison, Amy C.; Woodward, Lindsay; Colwell, Jamie (2016). What Are Preadolescent Readers Doing Online? An Examination of Upper Elementary Students' Reading, Writing, and Communication in Digital Spaces. *Read. Res. Q.*, 51 (4): 435-454. doi:10.1002/rrq.146
- Hutchison, Amy; Beschorner, Beth (2015). Using the iPad as a tool to support literacy instruction, 24 (4): 407--422.

- Hwang, Gwo-Jen; Chang, Shao-Chen (2016). Effects of a peer competition-based mobile learning approach on students' affective domain exhibition in social studies courses. *Br. J. Educ. Technol.*, 47 (6): 1217-1231. doi:10.1111/bjet.12303
- Hwang, Gwo-Jen; Hung, Chun-Ming; Chen, Nian-Shing (2014). Improving learning achievements, motivations and problem-solving skills through a peer assessment-based game development approach. *ETR&D-Educ. Tech. Res. Dev.*, 62 (2): 129-145. doi:10.1007/s11423-013-9320-7
- Hwang, Gwo-Jen; Lai, Chiu-Lin (2017). Facilitating and Bridging Out-Of-Class and In-Class Learning: An Interactive E-Book-Based Flipped Learning Approach for Math Courses. *Educ. Technol. Soc.*, 20 (1): 184-197.
- Hwang, Gwo-Jen; Sung, Han-Yu; Chang, Hsuan (2017). Effects of concept-mapping-based interactive e-books on active and reflective-style students' learning performances in junior high school law courses. *Interact. Learn. Environ.*, 25 (7): 877-888. doi:10.1080/10494820.2016.1224253
- Hwang, Gwo-Jen; Sung, Han-Yu; Hung, Chun-Ming; Huang, Iwen; Tsai, Chin-Chung (2012). Development of a personalized educational computer game based on students' learning styles. *ETR&D-Educ. Tech. Res. Dev.*, 60 (4): 623-638. doi:10.1007/s11423-012-9241-x
- Hwang, Gwo-Jen; Wu, Po-Han; Chen, Chi-Chang; Tu, Nien-Ting (2016). Effects of an augmented reality-based educational game on students' learning achievements and attitudes in real-world observations. *Interact. Learn. Environ.*, 24 (8): 1895-1906. doi:10.1080/10494820.2015.1057747
- Hwang, Wu-Yuin; Liu, Yi-Fan; Chen, Hon-Ren; Huang, Jian-Wun; Li, Jin-Yi (2015). Role of Parents and Annotation Sharing in Children's Learning Behavior and Achievement Using E-Readers. *Educ. Technol. Soc.*, 18 (1): 292-307.
- Hwang, Wu-Yuin; Shadiey, Rustam; Tseng, Chi-Wei; Huang, Yueh-Min (2015). Exploring Effects of Multi-Touch Tabletop on Collaborative Fraction Learning and the Relationship of Learning Behavior and Interaction with Learning Achievement. *Educ. Technol. Soc.*, 18 (4): 459-473.
- Ihmeideh, Fathi; Alkhawaldeh, Mustafa (2017). Teachers' and parents' perceptions of the role of technology and digital media in developing child culture in the early years. *Child. Youth Serv. Rev.*, 77: 139-146. doi:10.1016/j.chilyouth.2017.04.013
- Ince, Ebru Yilmaz; Demirbilek, Muhammet (2013). Secondary and High School Teachers' Perceptions Regarding Computer Games with Educational Features in Turkey. *Anthropologist*, 16 (42767): 89-96.
- International Ergonomics Assoc (2006). ECEE Guidelines. <http://www.iea.cc/ECEE/guidelines.html>
- Irawan, Vincentius Tjandra; Sutadji, Eddy; Widiyanti (2017). Blended learning based on schoology: Effort of improvement learning outcome and practicum chance in vocational high school. *Cogent Educ.*, 4: 1282031. doi:10.1080/2331186X.2017.1282031
- Isayama, Daiki; Ishiyama, Masaki; Relator, Raissa; Yamazaki, Koichi (2017). Computer Science Education for Primary and Lower Secondary School Students: Teaching the Concept of Automata. *ACM Trans. Comput. Educ.*, 17 (1): 2. doi:10.1145/2940331
- Iserbyt, Peter; Charlier, Nathalie; Mols, Liesbet (2014). Learning basic life support (BLS) with tablet PCs in reciprocal learning at school: Are videos superior to pictures? A randomized controlled trial. *Resuscitation*, 85 (6): 809-813. doi:10.1016/j.resuscitation.2014.01.018
- Jackson, G. Tanner; McNamara, Danielle S. (2013). Motivation and Performance in a Game-Based Intelligent Tutoring System. *J. Educ. Psychol.*, 105 (4): 1036-1049. doi:10.1037/a0032580
- Jacobs, Karen; Kaldenberg, Jennifer; Markowitz, Jackie; Wuest, Ellen; Hellman, Miranda; Umez-Eronini, Amarachi; Arsenault, Michael; Walker, Bryce; Hall, Victoria; Ciccarella, Marina; Parsons, Richard; Barr, Alice (2013). An ergonomics training program for student notebook computer users: Preliminary outcomes of a six-year cohort study. *Work*, 44 (2): 221-230. doi:10.3233/WOR-121584
- Jamil, Izdihar; Montero, Calkin Suero; Perry, Mark; O'Hara, Kenton; Karnik, Abhijit; Pihlainen, Kaisa; Marshall, Mark T.; Jha, Swathi; Gupta, Sanjay; Subramanian, Sriram (2017). Collaborating around Digital Tabletops: Children's Physical Strategies from India, the UK and Finland. *ACM Trans. Comput.-Hum. Interact.*, 24 (3): 23. doi:10.1145/3058551

- Jang, Syh-Jong (2009). Exploration of secondary students' creativity by integrating web-based technology into an innovative science curriculum. *Comput. Educ.*, 52 (1): 247-255. doi:10.1016/j.compedu.2008.08.002
- Jaroslawska, Agnieszka J.; Gathercole, Susan E.; Logie, Matthew R.; Holmes, Joni (2016). Following instructions in a virtual school: Does working memory play a role? *Mem. Cogn.*, 44 (4): 580-589. doi:10.3758/s13421-015-0579-2
- Jeffries, Tricia; Crosland, Kimberly; Miltenberger, Raymond (2016). Evaluating a tablet application and differential reinforcement to increase eye contact in children with autism. *Journal of Applied Behavior Analysis*, 49 (1): 182--187.
- Jiang, Xiao-Xiao; Hardy, Louise L.; Ding, Ding; Baur, Louise A.; Shi, Hui-Jing (2014). Recreational Screen-Time Among Chinese Adolescents: A Cross-Sectional Study. *Journal of Epidemiology*, 24 (5): 397--403.
- Johnson, Genevieve Marie (2013). Using Tablet Computers with Elementary School Students with Special Needs: The Practices and Perceptions of Special Education Teachers and Teacher Assistants. *Canadian Journal of Learning & Technology*, 39 (4): 1--12.
- Johnson, Kevin B.; Patterson, Barron L.; Ho, Yun-Xian; Chen, Qingxia; Nian, Hui; Davison, Coda L.; Slagle, Jason; Mulvaney, Shelagh A. (2016). The feasibility of text reminders to improve medication adherence in adolescents with asthma. *Journal of the American Medical Informatics Association*, 23 (3): 449--455.
- Johnson, Norah; Bree, Octavia; Lalley, Erin E.; Rettler, Kelly; Grande, Pam; Gani, Md O.; Ahamed, Sheikh I. (2014). Effect of a Social Script iPad Application for Children With Autism Going to Imaging. *Journal of Pediatric Nursing*, 29 (6): 651--659.
- Jong, Morris Siu-yung; Tsai, Chin-Chung (2016). Understanding the concerns of teachers about leveraging mobile technology to facilitate outdoor social inquiry learning: the EduVenture experience. *INTERACTIVE LEARNING ENVIRONMENTS*, 24 (2): 328--344.
- Jordan, Kerry E.; Baker, Joseph (2011). Multisensory information boosts numerical matching abilities in young children. *Dev. Sci.*, 14 (2): 205-213. doi:10.1111/j.1467-7687.2010.00966.x
- Jorgensen, Robyn; Lowrie, Tom (2013). Both ways strong: using digital games to engage Aboriginal learners. *Int. J. Incl. Educ.*, 17 (2): 130-142. doi:10.1080/13603116.2011.605912
- Kao, Gloria Yi-Ming; Tsai, Chin-Chung; Liu, Chia-Yu; Yang, Cheng-Han (2016). The effects of high/low interactive electronic storybooks on elementary school students' reading motivation, story comprehension and chromatics concepts. *Comput. Educ.*, 100: 56-70. doi:10.1016/j.compedu.2016.04.013
- Kappos, Andreas D. (2007). The impact of electronic media on mental and somatic children's health. *INTERNATIONAL JOURNAL OF HYGIENE AND ENVIRONMENTAL HEALTH*, 210 (5): 555-562. doi:10.1016/j.ijheh.2007.07.003
- Karadag, Ruhan (2015). Pre-service Teachers' Perceptions on Game Based Learning Scenarios in Primary Reading and Writing Instruction Courses. *Educ. Sci.-Theory Pract.*, 15 (1): 185-200. doi:10.12738/estp.2015.1.2634
- Karaseva, Agnese; Siibak, Andra; Pruulmann-Vengerfeldt, Pille (2015). Relationships between teachers' pedagogical beliefs, subject cultures, and mediation practices of students' use of digital technology. *Cyberpsychology*, 9 (1): UNSP 6. doi:10.5817/CP2015-1-6
- Katsionis, George; Virvou, Maria (2008). Personalised e-learning through an educational virtual reality game using Web services. *Multimed. Tools Appl.*, 39 (1): 47-71. doi:10.1007/s11042-007-0155-2
- Kaufman, David; Sauve, Louise; Renaud, Lise (2011). Enhancing Learning Through an Online Secondary School Educational Game. *J. Educ. Comput. Res.*, 44 (4): 409-428. doi:10.2190/EC.44.4.c
- Kaufman, J., Leung, S., Perry, C., Tarasuik, J., Highfield, K., Guy, J., & the Swinburne Babylab team. (2017). Evaluation of the Early Learning Languages Australia apps: Final report to the Australian

- Government Department of Education and Training. Melbourne, Australia: Swinburne University of Technology. ISBN: 978-1-76051-076-3
- Ke, Fengfeng (2008). A case study of computer gaming for math: Engaged learning from gameplay? *Computers & Education*, 51 (4): 1609--1620.
- Kelley, Elizabeth S.; Kinney, Kara (2017). Word Learning and Story Comprehension From Digital Storybooks: Does Interaction Make a Difference? *J. Educ. Comput. Res.*, 55 (3): 410-428. doi:10.1177/0735633116669811
- Kemp, Coral; Stephenson, Jennifer; Cooper, Megan; Hodge, Kerry (2016). Engaging Preschool Children With Severe and Multiple Disabilities Using Books and iPad Apps. *Infants & Young Children: An Interdisciplinary Journal of Early Childhood Intervention*, 29 (4): 249--266.
- Kendrick, Maureen; Early, Margaret; Chemjor, Walter (2013). Integrated Literacies in a Rural Kenyan Girls' Secondary School Journalism Club. *Res. Teach. Engl.*, 47 (4): 391-419.
- Kenney, Erica L.; Gortmaker, Steven L. (2017). United States Adolescents' Television, Computer, Videogame, Smartphone, and Tablet Use: Associations with Sugary Drinks, Sleep, Physical Activity, and Obesity. *J. Pediatr.*, 182: 144-149. doi:10.1016/j.jpeds.2016.11.015
- Keraroudi, Marjan Latifie; Shalmani, Hamed Babaie; Pourmohammadi, Majid (2016). ON THE EFFECT OF DIGITAL GAMES ON IRANIAN PRIMARY SCHOOL STUDENTS' VOCABULARY RETENTION. *Mod. J. Lang. Teach. Methods*, 6 (4): 132-139.
- Kids at Play (2017). Good habits for life. <https://goodhabitsforlife.act.gov.au/kids-at-play/recommended-screen-time-limits-0>
- KidsHealth (2016). Screen time guidelines for big kids. <http://kidshealth.org/en/parents/screentime-bigkids.html>
- KidsMatter. Strategies for screen time. <https://www.kidsmatter.edu.au/families/enewsletter/strategies-screen-time>
- KidSpot (2013). A parents' guide to screen smart kids. <http://www.kidspot.com.au/parenting/parenthood/parenting-style/a-parents-guide-to-screen-smart-kids/news-story/f53a8f8e66965048573ee695707eb4b8>
- Kiefer, Markus; Schuler, Stefanie; Mayer, Carmen; Trumpp, Natalie M.; Hille, Katrin; Sachse, Steffi (2015). Handwriting or Typewriting? The Influence of Pen or Keyboard-Based Writing Training on Reading and Writing Performance in Preschool Children. *Adv. Cogn. Psychol.*, 11 (4): 136-146. doi:10.5709/acp-0178-7
- Kiili, Kristian; Perttula, Pauliina Tuomi Arttu (2012). Exerbraining for Schools: Combining Body and Brain Training. *Procedia Computer Science*, 15: 163--173.
- Kildan, Abdullah Oguzhan; Incikabi, Lutfi (2015). Effects on the technological pedagogical content knowledge of early childhood teacher candidates using digital storytelling to teach mathematics. *Educ. 3-13*, 43 (3): 238-248. doi:10.1080/03004279.2013.804852
- Kim, Dong-Hyun; So, Wi-Young (2012). The relationship between daily Internet use time and school performance in Korean adolescents. *Cent. Eur. J. Med.*, 7 (4): 444-449. doi:10.2478/s11536-012-0019-7
- Kim, Eunjin (2013). Music technology-mediated teaching and learning approach for music education: A case study from an elementary school in South Korea. *Int. J. Music Educ.*, 31 (4): 413-427. doi:10.1177/0255761413493369
- Kim, Heesung; Ke, Fengfeng (2017). Effects of game-based learning in an OpenSim-supported virtual environment on mathematical performance. *Interact. Learn. Environ.*, 25 (4): 543-557. doi:10.1080/10494820.2016.1167744
- Kim, Joowon; Hwang, Yunji; Kang, Seungheon; Kim, Minhye; Kim, Tae-Shin; Kim, Jay; Seo, Jeongmin; Ahn, Hyeon; Yoon, Sungjoon; Yun, Jun Pil; Lee, Yae Lim; Ham, Hyunsoo; Yu, Hyeong Gon; Park, Sue K. (2016). Association between Exposure to Smartphones and Ocular Health in Adolescents. *Ophthalmic Epidemiol.*, 23 (4): 269-276. doi:10.3109/09286586.2015.1136652

- Kim, Paul; Buckner, Elizabeth; Kim, Hyunkyung; Makany, Tamas; Taleja, Neha; Parikh, Vallabhi (2012). A comparative analysis of a game-based mobile learning model in low-socioeconomic communities of India. *International Journal of Educational Development*, 32 (2): 329--340.
- Kim, Paul; Hagashi, Teresita; Carillo, Laura; Gonzales, Irina; Makany, Tamas; Lee, Bommi; Garate, Alberto (2011). Socioeconomic strata, mobile technology, and education: a comparative analysis. *Educational Technology Research and Development*, 59 (4): 465--486.
- Kim, Yanghee (2013). Digital Peers to Help Children's Text Comprehension and Perceptions. *Educ. Technol. Soc.*, 16 (4): 59-70.
- Kim, Yanghee; Smith, Diantha (2017). Pedagogical and technological augmentation of mobile learning for young children interactive learning environments. *Interact. Learn. Environ.*, 25 (1): 4-16. doi:10.1080/10494820.2015.1087411
- King, Melissa L.; Takeguchi, Kazu; Barry, Shaina E.; Rehfeldt, Ruth Anne; Boyer, Valerie E.; Mathews, Therese L. (2014). Evaluation of the iPad in the acquisition of requesting skills for children with autism spectrum disorder. *Research in Autism Spectrum Disorders*, 8 (9): 1107--1120.
- Kirkorian, Heather L.; Choi, Koeun; Pempek, Tiffany A. (2016). Toddlers' Word Learning From Contingent and Noncontingent Video on Touch Screens. *Child Dev.*, 87 (2): 405-413. doi:10.1111/cdev.12508
- Kjällander, S., & Moinian, F. (2014). Digital tablets and applications in preschool – Preschoolers' creative transformation of didactic design. *Designs for Learning*, 7(1), 10–33. doi:http://doi.org/10.2478/dfl-2014-0009
- Kjällander, Susanne; Moinian, Farzaneh; Dorls, Patrick (2016). Mother tongue language teaching with digital tablets in early childhood education: A question of social inclusion and equity. *He Kupu*, 4 (3): 19-29.
- Knauf, Helen (2016). Interlaced social worlds: exploring the use of social media in the kindergarten. *Early Years*, 36 (3): 254-270. doi:10.1080/09575146.2016.1147424
- Knight, Kathryn; Davies, Randall S. (2016). Using a Mobile Dichotomous Key iPad application as a scaffolding tool in a museum setting. *Interactive Learning Environments*, 24 (4): 814--828.
- Kocaman-Karoglu, Aslihan (2015). Telling stories digitally: an experiment with preschool children. *Educ. Media Int.*, 52 (4): 340-352. doi:10.1080/09523987.2015.1100391
- Kolikant, Yifat Ben-David (2010). Digital natives, better learners? Students' beliefs about how the Internet influenced their ability to learn. *Comput. Hum. Behav.*, 26 (6): 1384-1391. doi:10.1016/j.chb.2010.04.012
- Kong, Siu Cheung (2014). Developing information literacy and critical thinking skills through domain knowledge learning in digital classrooms: An experience of practicing flipped classroom strategy. *Comput. Educ.*, 78: 160-173. doi:10.1016/j.compedu.2014.05.009
- Kooiman, Brian J.; Sheehan, Dwayne P.; Wesolek, Michael; Reategui, Eliseo (2016). Exergaming for Physical Activity in Online Physical Education. *Int. J. Distance Educ. Technol.*, 14 (2): 1-16. doi:10.4018/IJDET.2016040101
- Korat, O.; Shamir, A. (2008). The educational electronic book as a tool for supporting children's emergent literacy in low versus middle SES groups. *Comput. Educ.*, 50 (1): 110-124. doi:10.1016/j.compedu.2006.04.002
- Korat, Ofra; Blau, Hila (2010). Repeated Reading of CD-ROM Storybook as a Support for Emergent Literacy: A Developmental Perspective in Two SES Groups. *J. Educ. Comput. Res.*, 43 (4): 445-466. doi:10.2190/EC.43.4.b
- Korat, Ofra; Segal-Drori, Ora; Klien, Pnina (2009). Electronic and Printed Books With and Without Adult Support as Sustaining Emergent Literacy. *J. Educ. Comput. Res.*, 41 (4): 453-475. doi:10.2190/EC.41.4.d
- Korat, Ofra; Shamir, Adina (2012). Direct and Indirect Teaching: Using E-Books for Supporting Vocabulary, Word Reading, and Story Comprehension for Young Children. *Journal of Educational Computing Research*, 46 (2): 135--152.

- Korat, Ofra; Shamir, Adina; Heibal, Shani (2013). Expanding the boundaries of shared book reading: E-books and printed books in parent-child reading as support for children's language. *First Lang.*, 33 (5): 504-523. doi:10.1177/0142723713503148
- Korkmaz, Oezgen; Karakus, Ufuk (2009). The Impact of Blended Learning Model on Student Attitudes Towards Geography Course and their Critical Thinking Dispositions and Levels. *Turk. Online J. Educ. Technol.*, 8 (4): 51-63.
- Kornmann, Jessica; Kammerer, Yvonne; Zettler, Ingo; Trautwein, Ulrich; Gerjets, Peter (2016). Hypermedia exploration stimulates multiperspective reasoning in elementary school children with high working memory capacity: A tablet computer study. *Learn. Individ. Differ.*, 51: 273-283. doi:10.1016/j.lindif.2016.08.041
- Kostyrka-Allchorne, Katarzyna; Cooper, Nicholas R.; Simpson, Andrew (2017). Touchscreen generation: children's current media use, parental supervision methods and attitudes towards contemporary media. *Acta Paediatr.*, 106 (4): 654-662. doi:10.1111/apa.13707
- Kucirkova, Natalia; Littleton, Karen (2017). Developing personalised education for personal mobile technologies with the pluralisation agenda. *Oxf. Rev. Educ.*, 43 (3): 276-288. doi:10.1080/03054985.2017.1305046
- Kucirkova, Natalia; Messer, David; Sheehy, Kieron; Fernandez Panadero, Carmen (2014). Children's engagement with educational iPad apps: Insights from a Spanish classroom. *Comput. Educ.*, 71: 175-184. doi:10.1016/j.compedu.2013.10.003
- Kucuk, Sevda; Yilmaz, Rabia M.; Goktas, Yuksel (2014). Augmented Reality for Learning English: Achievement, Attitude and Cognitive Load Levels of Students. *Egit. Bilim*, 39 (176): 393-404.
- Kuhn, Jochen; Lukowicz, Paul; Hirth, Michael; Poxrucker, Andreas; Weppner, Jens; Younas, Junaid (2016). gPhysics-Using Smart Glasses for Head-Centered, Context-Aware Learning in Physics Experiments. *IEEE Trans. Learn. Technol.*, 9 (4): 304-317. doi:10.1109/TLT.2016.2554115
- Kwok, Kristine; Ghrear, Siba; Li, Vivian; Haddock, Taeh; Coleman, Patrick; Birch, Susan A. J. (2016). Children Can Learn New Facts Equally Well From Interactive Media Versus Face to Face Instruction. *Front. Psychol.*, 7: 1603. doi:10.3389/fpsyg.2016.01603
- Lai, C.-H.; Yang, J.-C.; Chen, F.-C.; Ho, C.-W.; Chan, T.-W. (2007). Affordances of mobile technologies for experiential learning: the interplay of technology and pedagogical practices. *J. Comput. Assist. Learn.*, 23 (4): 326-337. doi:10.1111/j.1365-2729.2007.00237.x
- Lan, Yu-Ju (2015). Contextual EFL Learning in a 3D Virtual Environment. *Lang. Learn. Technol.*, 19 (2): 16-31.
- Lan, Yu-Ju; Sung, Yao-Ting; Chang, Kuo-En (2007). A mobile-device-supported peer-assisted learning system for collaborative early EFL reading. *Lang. Learn. Technol.*, 11 (3): 130-151.
- Lan, Yu-Ju; Sung, Yao-Ting; Chang, Kuo-En (2009). Let us read together: Development and evaluation of a computer-assisted reciprocal early English reading system. *Comput. Educ.*, 53 (4): 1188-1198. doi:10.1016/j.compedu.2009.06.002
- Lan, Yu-Ju; Sung, Yao-Ting; Tan, Ning-chun; Lin, Chiu-Pin; Chang, Kuo-En (2010). Mobile-Device-Supported Problem-Based Computational Estimation Instruction for Elementary School Students. *Educ. Technol. Soc.*, 13 (3): 55-69.
- Land, Susan M.; Zimmerman, Heather Toomey (2015). Socio-technical dimensions of an outdoor mobile learning environment: a three-phase design-based research investigation. *ETR&D-Educ. Tech. Res. Dev.*, 63 (2): 229-255. doi:10.1007/s11423-015-9369-6
- Lau, Patrick W. C.; Liang, Yan; Lau, Erica Y.; Choi, Choung-Rak; Kim, Chang-Gyun; Shin, Myung-Soo (2015). Evaluating Physical and Perceptual Responses to Exergames in Chinese Children. *Int. J. Environ. Res. Public Health*, 12 (4): 4018-4030. doi:10.3390/ijerph120404018
- Lauricella, Alexis R.; Barr, Rachel; Calvert, Sandra L. (2016). Toddler learning from video: Effect of matched pedagogical cues. *Infant Behav. Dev.*, 45: 22-30. doi:10.1016/j.infbeh.2016.08.001
- Law, Victor; Chen, Ching-Huei (2016). Promoting science learning in game-based learning with question prompts and feedback. *Comput. Educ.*, 103: 134-143. doi:10.1016/j.compedu.2016.10.005

- LEAPS. Screen time.
- Leatherdale, S. T.; Ahmed, R. (2011). Screen-based sedentary behaviours among a nationally representative sample of youth: Are Canadian kids couch potatoes? *Chronic Diseases and Injuries in Canada*.
- Lee, Cynthia; Cheung, William Kwok Wai; Wong, Kelvin Chi Kuen; Lee, Fion Sau Ling (2013). Immediate web-based essay critiquing system feedback and teacher follow-up feedback on young second language learners' writings: an experimental study in a Hong Kong secondary school. *Comput. Assist. Lang. Learn.*, 26 (1): 39-60. doi:10.1080/09588221.2011.630672
- Lee, Elinda Ai-Lim; Wong, Kok Wai (2014). Learning with desktop virtual reality: Low spatial ability learners are more positively affected. *Comput. Educ.*, 79: 49-58. doi:10.1016/j.compedu.2014.07.010
- Lee, Lay Wah (2016). Multisensory modalities for blending and segmenting among early readers. *Comput. Assist. Lang. Learn.*, 29 (5): 1019-1034. doi:10.1080/09588221.2015.1129347
- Lee, Sung Hee (2017). Learning vocabulary through e-book reading of young children with various reading abilities. *Read. Writ.*, 30 (7): 1595-1616. doi:10.1007/s11145-017-9740-6
- Lee, Szu-Hsin (2016). Primary Study of Attitudes of Schoolchildren in Rural and Remote Areas Toward Digital Imaging Learning-Taking Film-Making Summer Camp as an Example. *Eurasia J. Math. Sci. Technol. Educ.*, 12 (5): 1469-1475.
- Lee, Tai-Hua; Wu, Fong-Gong; Chen, Huei-Tsz (2017). Innovation & evaluation of tangible direct manipulation digital drawing pens for children. *Appl. Ergon.*, 60: 207-219. doi:10.1016/j.apergo.2016.11.014
- Leinonen, Teemu; Keune, Anna; Veermans, Marjaana; Toikkanen, Tarmo (2016). Mobile apps for reflection in learning: A design research in K-12 education. *British Journal of Educational Technology*, 47 (1): 184--202.
- Lemola, Sakari; Perkinson-Gloor, Nadine; Brand, Serge; Dewald-Kaufmann, Julia F.; Grob, Alexander (2015). Adolescents' Electronic Media Use at Night, Sleep Disturbance, and Depressive Symptoms in the Smartphone Age. *J. Youth Adolesc.*, 44 (2): 405-418. doi:10.1007/s10964-014-0176-x
- Leon M. Straker, Anne J. Smith, Natasha Bear, Peter B. O'Sullivan & Nicholas H. de Klerk (2011). Neck/shoulder pain, habitual spinal posture and computer use in adolescents: the importance of gender. *Ergonomics*. 54(6): 539-546. doi.org/10.1080/00140139.2011.576777
- Lepicnik, Jurka; Samec, Pija (2013). Communication Technology in the Home Environment of Four-year-old Children (Slovenia). *Comunicar*, (40): 119-126. doi:10.3916/C40-2013-03-02
- Li, Benjamin J.; Lwin, May O.; Jung, Younbo (2014). Wii, Myself, and Size: The Influence of Proteus Effect and Stereotype Threat on Overweight Children's Exercise Motivation and Behavior in Exergames. *Games Health J.*, 3 (1): 40-48. doi:10.1089/g4h.2013.0081
- Li, Jia; Snow, Catherine; White, Claire (2015). Urban adolescent students and technology: access, use and interest in learning language and literacy. *Innov. Lang. Learn. Teach.*, 9 (2): 143-162. doi:10.1080/17501229.2014.882929
- Liang, P-S.; Nicolini, A. M.; Ogden, K. L.; Yoon, J-Y. (2015). Use of Biosensors in Secondary Education Classrooms. *Trans. ASABE*, 58 (2): 181-190.
- Liang, T. -H. (2015). The effects of keyword cues and 3R strategy on children's e-book reading. *J. Comput. Assist. Learn.*, 31 (2): 176-187. doi:10.1111/jcal.12072
- Liang, Tsung-Ho; Huang, Yueh-Min (2014). An Investigation of Reading Rate Patterns and Retrieval Outcomes of Elementary School Students with E-books. *Educ. Technol. Soc.*, 17 (1): 218-230.
- Lin, Chien-Heng; Chen, Chien -Min (2016). Developing spatial visualization and mental rotation with a digital puzzle game at primary school level. *Comput. Hum. Behav.*, 57: 23-30. doi:10.1016/j.chb.2015.12.026
- Lin, Chien-Yu; Chai, Hua-Chen; Wang, Jui-ying; Chen, Chien-Jung; Liu, Yu-Hung; Chen, Ching-Wen; Lin, Cheng-Wei; Huang, Yu-Mei (2016). Augmented reality in educational activities for children with disabilities. *Displays*, 42: 51-54. doi:10.1016/j.displa.2015.02.004

- Lin, Chih-cheng (2014). Learning English reading in a mobile-assisted extensive reading program. *Comput. Educ.*, 78: 48-59. doi:10.1016/j.compedu.2014.05.004
- Lin, Chih-Cheng; Yu, Ya-Chuan (2017). Effects of presentation modes on mobile-assisted vocabulary learning and cognitive load.. *Interactive Learning Environments*, 25 (4): 528--542.
- Lin, Chiu-Pin; Shao, Yin-juan; Wong, Lung-Hsiang; Li, Yin-Jen; Niramitranon, Jitti (2011). The Impact of Using Synchronous Collaborative Virtual Tangram in Children's Geometric. *Turk. Online J. Educ. Technol.*, 10 (2): 250-258.
- Lin, Chun-Hung; Liu, Eric Zhi-Feng; Chen, Yu-Liang; Liou, Pey-Yan; Chang, Maiga; Wu, Cheng-Hong; Yuan, Shyan-Ming (2013). Game-Based Remedial Instruction in Mastery Learning for Upper-Primary School Students. *Educ. Technol. Soc.*, 16 (2): 271-281.
- Lin, Hao-Chiang Koong; Chen, Mei-Chi; Chang, Chih-Kai (2015). Assessing the effectiveness of learning solid geometry by using an augmented reality-assisted learning system. *Interact. Learn. Environ.*, 23 (6): 799-810. doi:10.1080/10494820.2013.817435
- Lin, Ming-Chao; Tutwiler, M. Shane; Chang, Chun-Yen (2011). Exploring the relationship between virtual learning environment preference, use, and learning outcomes in 10th grade earth science students. *Learn. Media Technol.*, 36 (4): 399-417. doi:10.1080/17439884.2011.629660
- Lin, Ya-Wen; Tseng, Chih-Lung; Chiang, Po-Jui (2017). The Effect of Blended Learning in Mathematics Course. *Eurasia J. Math. Sci. Technol. Educ.*, 13 (3): 741-770. doi:10.12973/eurasia.2017.00641a
- Lindberg, Renny; Seo, Jungryul; Laine, Teemu H. (2016). Enhancing Physical Education with Exergames and Wearable Technology. *IEEE Trans. Learn. Technol.*, 9 (4): 328-341. doi:10.1109/TLT.2016.2556671
- Linebarger, Deborah L.; Piotrowski, Jessica Taylor (2009). TV as storyteller: How exposure to television narratives impacts at-risk preschoolers' story knowledge and narrative skills. *British Journal of Developmental Psychology*, 27 (1): 47--69.
- Lingwood, Jamie; Blades, Mark; Farran, Emily K.; Courbois, Yannick; Matthews, Danielle (2015). Encouraging 5-year olds to attend to landmarks: a way to improve children's wayfinding strategies in a virtual environment. *Front. Psychol.*, 6: 174. doi:10.3389/fpsyg.2015.00174
- Liu, Chen-Chung; Wang, Pin-Ching; Tai, Shu-Ju Diana (2016). An analysis of student engagement patterns in language learning facilitated by Web 2.0 technologies. *ReCALL*, 28 (2): 104-122. doi:10.1017/S095834401600001X
- Liu, Chia-Yu; Wu, Chao-Jung; Wong, Wing-Kwon; Lien, Yunn-Wen; Chao, Tsung-Kai (2017). Scientific modeling with mobile devices in high school physics labs. *Comput. Educ.*, 105: 44-56. doi:10.1016/j.compedu.2016.11.004
- Liu, Tsung-Yu; Chu, Yu-Ling (2010). Using ubiquitous games in an English listening and speaking course: Impact on learning outcomes and motivation. *Comput. Educ.*, 55 (2): 630-643. doi:10.1016/j.compedu.2010.02.023
- Lorah, Elizabeth & Parnell, Ashley & Renee Speight, D. (2014). Acquisition of sentence frame discrimination using the iPad TM as a speech generating device in young children with developmental disabilities. *Research in Autism Spectrum Disorders*, 8. doi:10.1016/j.rasd.2014.09.004.
- Lorenzo, Gonzalo; Lledo, Asuncion; Pomares, Jorge; Roig, Rosabel (2016). Design and application of an immersive virtual reality system to enhance emotional skills for children with autism spectrum disorders. *Comput. Educ.*, 98: 192-205. doi:10.1016/j.compedu.2016.03.018
- Lu, Su-Ju; Liu, Ying-Chieh (2015). Integrating augmented reality technology to enhance children's learning in marine education. *Environ. Educ. Res.*, 21 (4): 525-541. doi:10.1080/13504622.2014.911247
- Lucht, Martina; Heidig, Steffi (2013). Applying HOPSCOTCH as an exer-learning game in English lessons: two exploratory studies. *ETR&D-Educ. Tech. Res. Dev.*, 61 (5): 767-792. doi:10.1007/s11423-013-9308-3

- Lwin, May O.; Malik, Shelly (2012). The efficacy of exergames-incorporated physical education lessons in influencing drivers of physical activity: A comparison of children and pre-adolescents. *Psychol. Sport Exerc.*, 13 (6): 756-760. doi:10.1016/j.psychsport.2012.04.013
- Lysenko, Larysa V.; Abrami, Philip C. (2014). Promoting reading comprehension with the use of technology. *Comput. Educ.*, 75: 162-172. doi:10.1016/j.compedu.2014.01.010
- Ma, Min-Yuan; Wei, Chun-Chun (2016). A comparative study of children's concentration performance on picture books: age, gender, and media forms. *Interact. Learn. Environ.*, 24 (8): 1922-1937. doi:10.1080/10494820.2015.1060505
- Mak, Yim Wah; Wu, Cynthia Sau Ting; Hui, Donna Wing Shun; Lam, Siu Ping; Tse, Hei Yin; Yu, Wing Yan; Wong, Ho Ting (2014). Association between Screen Viewing Duration and Sleep Duration, Sleep Quality, and Excessive Daytime Sleepiness among Adolescents in Hong Kong. *International Journal of Environmental Research and Public Health*, 11 (11): 11201--11219.
- Maloney, Ann E.; Stempel, Audrey; Wood, Mollie E.; Patraitis, Cynthia; Beaudoin, Christina (2012). Can Dance Exergames Boost Physical Activity as a School-Based Intervention? *Games Health J.*, 1 (6): 416-421. doi:10.1089/g4h.2011.0010
- Manero, Borja; Torrente, Javier; Serrano, Angel; Martinez-Ortiz, Ivan; Fernandez-Manjon, Baltasar (2015). Can educational video games increase high school students' interest in theatre? *Comput. Educ.*, 87: 182-191. doi:10.1016/j.compedu.2015.06.006
- Mannikko, Niko; Billieux, Joel; Kaariainen, Maria (2015). Problematic digital gaming behavior and its relation to the psychological, social and physical health of Finnish adolescents and young adults. *J. Behav. Addict.*, 4 (4): 281-288. doi:10.1556/2006.4.2015.040
- Manoharan R (2017). Screen time: how much is right? <https://www.asg.com.au/asg-blogs/asg-blog/2017/03/06/screen-time-how-much-is-right>
- Mao, Jin (2014). Social media for learning: A mixed methods study on high school students' technology affordances and perspectives. *Comput. Hum. Behav.*, 33: 213-223. doi:10.1016/j.chb.2014.01.002
- Marsh, Samantha; Mhurchu, Cliona Ni; Jiang, Yannan; Maddison, Ralph (2015). Modern Screen-Use Behaviors: The Effects of Single- and Multi-Screen Use on Energy Intake. *J. Adolesc. Health*, 56 (5): 543-549. doi:10.1016/j.jadohealth.2015.01.009
- Martin del Pozo, Marta; Basilotta Gomez-Pablos, Veronica; Garcia-Valcarcel Munoz-Repiso, Ana (2017). A quantitative approach to pre-service primary school teachers' attitudes towards collaborative learning with video games: previous experience with video games can make the difference. *Int. J. Educ. Technol. High. Educ.*, 14: 11. doi:10.1186/s41239-017-0050-5
- Martin-Ramos, Pablo; Ramos Silva, Manuela; Pereira da Silva, Pedro S. (2017). Smartphones in the teaching of Physics Laws: Projectile motion. *RIED-Rev. Iberoam. Educ. Distancia*, 20 (2): 213-231. doi:10.5944/ried.20.2.17663
- Martin-SanJose, Juan-Fernando; Juan, M. -Carmen; Molla, Ramon; Vivo, Roberto (2017). Advanced displays and natural user interfaces to support learning. *Interact. Learn. Environ.*, 25 (1): 17-34. doi:10.1080/10494820.2015.1090455
- Maslen B, Straker L. (2009) A comparison of posture and muscle activity means and variation amongst young children, older children and young adults whilst working with computers. *Work*. 32(3):311-20. doi: 10.3233/WOR-2009-0829."
- Masood, Mona; Thigambaram, Menaga (2015). The Usability of Mobile Applications for Pre-schoolers. *Procedia - Social and Behavioral Sciences*, 197: 1818--1826.
- Matijevic, Milan; Topolovcan, Tomislav; Rajic, Visnja (2017). Teacher Assessment Related to the Use of Digital Media and Constructivist Learning in Primary and Secondary Education. *Croat. J. Educ.*, 19 (2): 563-586. doi:10.15516/cje.v19i2.2411
- MayoClinic (2016). Screen time and children - how to guide your child. <https://www.mayoclinic.org/healthy-lifestyle/childrens-health/in-depth/screen-time/art-20047952>

- Mazurek, Micah O.; Wenstrup, Colleen (2013). Television, Video Game and Social Media Use Among Children with ASD and Typically Developing Siblings. *J. Autism Dev. Disord.*, 43 (6): 1258-1271. doi:10.1007/s10803-012-1659-9
- McClain, Lucy R.; Zimmerman, Heather Toomey (2016). Technology-mediated engagement with nature: sensory and social engagement with the outdoors supported through an e-Trailguide. *Int. J. Sci. Educ. Part B-Commun. Public Engagem.*, 6 (4): 385-399. doi:10.1080/21548455.2016.1148827
- McEwen, Rhonda (2014). Mediating sociality: the use of iPod Touch (TM) devices in the classrooms of students with autism in Canada. *Info. Commun. Soc.*, 17 (10): 1264-1279. doi:10.1080/1369118X.2014.920041
- McKenzie, Sophie; Bangay, Shaun; Barnett, Lisa M.; Ridgers, Nicola D.; Salmon, Jo (2014). Design Elements and Feasibility of an Organized Multiplayer Mobile Active Videogame for Primary School-Aged Children. *Games Health J.*, 3 (6): 379-+. doi:10.1089/g4h.2013.0097
- McNarry, Melitta A.; Mackintosh, Kelly A. (2016). Investigating the Relative Exercise Intensity of Exergames in Prepubertal Children. *Games Health J.*, 5 (2): 135-140. doi:10.1089/g4h.2015.0094
- McVeigh J, Smith A, Howie E, Straker L. (2016). Trajectories of Television Watching from Childhood to Early Adulthood and Their Association with Body Composition and Mental Health Outcomes in Young Adults. *PLoS One.* 20; 11(4): e0152879. doi: 10.1371/journal.pone.0152879. eCollection 2016."
- McVeigh JA, Zhu K, Mountain J, Pennell CE, Lye SJ, Walsh JP, Straker LM. (2016). Longitudinal Trajectories of Television Watching Across Childhood and Adolescence Predict Bone Mass at Age 20 Years in the Raine Study. *J Bone Miner Res.* 31(11):2032-2040. doi: 10.1002/jbmr.2890.
- Medline Plus (2014). Screen time and children. <https://medlineplus.gov/ency/patientinstructions/000355.htm>
- Mei-Ju, Chou (2014). How are Our Prince and Princess Satisfying with iPad Learning. *Procedia - Social and Behavioral Sciences*, 116: 2857--2865.
- Meir, Anat; Oron-Gilad, Tal; Parmet, Yisrael (2015). Can child-pedestrians' hazard perception skills be enhanced? *Accid. Anal. Prev.*, 83: 101-110. doi:10.1016/j.aap.2015.07.006
- Mellecker, R. R.; McManus, A. M. (2014). Active video games and physical activity recommendations: A comparison of the Gamercize Stepper, XBOX Kinect and XaviX J-Mat. *J. Sci. Med. Sport*, 17 (3): 288-292. doi:10.1016/j.jsams.2013.05.008
- Melo, Mario; Miranda, Guilhermina Lobato (2015). Learning Electrical Circuits: The Effects of the 4C-ID Instructional Approach in the Acquisition and Transfer of Knowledge. *J. Inf. Technol. Educ.-Res.*, 14: 313-337.
- Mercier, E.; Higgins, S. (2014). Creating joint representations of collaborative problem solving with multi-touch technology. *J. Comput. Assist. Learn.*, 30 (6): 497-510. doi:10.1111/jcal.12052
- Merelle, Saskia Y. M.; Kleiboer, Annet M.; Schotanus, Miriam; Cluitmans, Theresia L. M.; Waardenburg, Cornelia M.; Kramer, Danielle; van de Mheen, Dike; van Rooij, Antonius J. (2017). Which Health-related Problems are Associated With Problematic Video-gaming or Social Media Use in Adolescents? A Large-scale Cross-sectional Study. *Clin. Neuropsychiatr.*, 14 (1): 11-19.
- Merga, Margaret K.; Roni, Saiyidi Mat (2017). The influence of access to eReaders, computers and mobile phones on children's book reading frequency. *Computers & Education*, 109: 187--196.
- Merkt, Martin; Weigand, Sonja; Heier, Anke; Schwan, Stephan (2011). Learning with videos vs. learning with print: The role of interactive features. *Learn Instr.*, 21 (6): 687-704. doi:10.1016/j.learninstruc.2011.03.004
- Merrill, Edward C.; Yang, Yingying; Roskos, Beverly; Steele, Sara (2016). Sex Differences in Using Spatial and Verbal Abilities Influence Route Learning Performance in a Virtual Environment: A Comparison of 6-to 12-Year Old Boys and Girls. *Front. Psychol.*, 7: 258. doi:10.3389/fpsyg.2016.00258
- Meza-Cordero, Jaime A. (2017). Learn to Play and Play to Learn: Evaluation of the One Laptop Per Child Program in Costa Rica. *J. Int. Dev.*, 29 (1): 3-31. doi:10.1002/jid.3267

- Miglietta, Annarita (2015). A School with iPad. *Procedia - Social and Behavioral Sciences*, 176: 95--102.
- Milde-Busch, Astrid; von Kries, Ruediger; Thomas, Silke; Heinrich, Sabine; Straube, Andreas; Radon, Katja (2010). The association between use of electronic media and prevalence of headache in adolescents: results from a population-based cross-sectional study. *BMC NEUROLOGY*, 10: 109-127. doi:10.1186/1471-2288-10-109
- Miletic, Ljiljana; Lesaja, Goran (2016). Research and evaluation of the effectiveness of e-learning in the case of linear programming. *Croat. Oper. Res. Rev.*, 7 (1): 109-127. doi:10.17535/cro.2016.0008
- Miller, Leslie M.; Chang, Ching-I.; Wang, Shu; Beier, Margaret E.; Klisch, Yvonne (2011). Learning and motivational impacts of a multimedia science game. *Comput. Educ.*, 57 (1): 1425-1433. doi:10.1016/j.compedu.2011.01.016
- Miller, Todd A.; Vaux-Bjerke, Alison; McDonnell, Karen A.; DiPietro, Loretta (2013). Can E-Gaming Be Useful for Achieving Recommended Levels of Moderate- to Vigorous-Intensity Physical Activity in Inner-City Children? *Games Health J.*, 2 (2): 96-102. doi:10.1089/g4h.2012.0058
- Mills, Kathy A.; Exley, Beryl (2014). Time, Space, and Text in the Elementary School Digital Writing Classroom. *Writ. Commun.*, 31 (4): 434-469. doi:10.1177/0741088314542757
- Mitchell, Louise E.; Ziviani, Jenny; Boyd, Roslyn N. (2016). A randomized controlled trial of web-based training to increase activity in children with cerebral palsy. *Dev. Med. Child Neurol.*, 58 (7): 767-773. doi:10.1111/dmcn.13065
- Mitnik, Ruben; Nussbaum, Miguel; Recabarren, Matias (2009). Developing Cognition with Collaborative Robotic Activities. *Educ. Technol. Soc.*, 12 (4): 317-330.
- Mitrofan O, Paul M, Spencer N. (2009). Is aggression in children with behavioural and emotional difficulties associated with television viewing and video game playing? A systematic review. *Child Care Health Dev.* 35(1):5-15. doi: 10.1111/j.1365-2214.2008.00912.x.
- Mo, Di; Swinnen, Johan; Zhang, Linxiu; Yi, Hongmei; Qu, Qinghe; Boswell, Matthew; Rozelle, Scott (2013). Can One-to-One Computing Narrow the Digital Divide and the Educational Gap in China? The Case of Beijing Migrant Schools. *World Dev.*, 46: 14-29. doi:10.1016/j.worlddev.2012.12.019
- Montrieux, Hannelore; Vanderlinde, Ruben; Schellens, Tammy; De Marez, Lieven (2015). Teaching and Learning with Mobile Technology: A Qualitative Explorative Study about the Introduction of Tablet Devices in Secondary Education. *PLoS One*, 10 (12): e0144008. doi:10.1371/journal.pone.0144008
- Moore, Dennis W.; Venkatesh, Svetha; Anderson, Angelika; Greenhill, Stewart; Phung, Dinh; Duong, Thi; Cairns, Darin; Marshall, Wendy; Whitehouse, Andrew J. O. (2015). TOBY play-pad application to teach children with ASD - A pilot trial. *Developmental Neurorehabilitation*, 18 (4): 213--217.
- Moosazadeh, Mahsa; Motallebzadeh, Khalil (2017). Improving Iranian EFL Learners' Vocabulary Retention and Attitudes Towards English Through Digital Story Telling: A Task-based Approach. *Mod. J. Lang. Teach. Methods*, 7 (1): 207-220.
- Morita, Noriteru; Nakajima, Toshihiro; Okita, Koichi; Ishihara, Toru; Sagawa, Masato; Yamatsu, Koji (2016). Relationships among fitness, obesity, screen time and academic achievement in Japanese adolescents. *Physiology & Behavior*, 163: 161--166.
- Moser, Alecia; Zimmermann, Laura; Dickerson, Kelly; Grenell, Amanda; Barr, Rachel; Gerhardstein, Peter (2015). They can interact, but can they learn? Toddlers' transfer learning from touchscreens and television. *J. Exp. Child Psychol.*, 137: 137-155. doi:10.1016/j.jecp.2015.04.002
- Moses A.M. (2008). Impacts of television viewing on young children's literacy development in the USA: A review of the literature. *Journal of Early Childhood Literacy*. 8(1) 67 – 102. doi:10.1177/1468798407087162
- Moyer-Packenham, Patricia.; Shumway, Jessica F.; Bullock, Emma; Tucker, Stephen I.; Anderson-Pence, Katie L.; Westenskow, Arla; Boyer-Thurgood, Jennifer; Maahs-Fladung, Cathy; Symanzik, Juergen; Mahamane, Sali F.; MacDonald, Beth; Jordan, Kerry. (2015). Young Children's Learning Performance and Efficiency when Using Virtual Manipulative Mathematics iPad Apps. *Journal of Computers in Mathematics & Science Teaching*, 34 (1): 41--69.

- Muis, Krista R.; Ranellucci, John; Trevors, Gregory; Duffy, Melissa C. (2015). The effects of technology-mediated immediate feedback on kindergarten students' attitudes, emotions, engagement and learning outcomes during literacy skills development. *Learn Instr.*, 38: 1-13. doi:10.1016/j.learninstruc.2015.02.001
- Munezawa, Takeshi; Kaneita, Yoshitaka; Osaki, Yoneatsu; Kanda, Hideyuki; Minowa, Masumi; Suzuki, Kenji; Higuchi, Susumu; Mori, Junichiro; Yamamoto, Ryuichiro; Ohida, Takashi (2011). The Association between Use of Mobile Phones after Lights Out and Sleep Disturbances among Japanese Adolescents: A Nationwide Cross-Sectional Survey. *SLEEP*, 34 (8): 1013--1020.
- Munoz-Cristobal, Juan A.; Jorin-Abellan, Ivan M.; Asensio-Perez, Juan I.; Martinez-Mones, Alejandra; Prieto, Luis P.; Dimitriadis, Yannis (2015). Supporting Teacher Orchestration in Ubiquitous Learning Environments: A Study in Primary Education. *IEEE Trans. Learn. Technol.*, 8 (1): 83-97. doi:10.1109/TLT.2014.2370634
- Muzellec, Laurent; Feenstra, Florence; de Faultrier, Brigitte; Boulay, Jacques (2016). Children's experiences and parents' perceptions of retailers' mobile applications. *Int. J. Retail Distrib. Manag.*, 44 (11): 1118-1131. doi:10.1108/IJRDM-11-2015-0169
- Myers, Lauren J.; LeWitt, Rachel B.; Gallo, Renee E.; Maselli, Nicole M. (2017). Baby FaceTime: can toddlers learn from online video chat? *Dev. Sci.*, 20 (4): e12430. doi:10.1111/desc.12430
- Nacher, Vicente; Jaen, Javier; Catala, Alejandro (2017). Evaluating Multitouch Semiotics to Empower Prekindergarten Instruction with Interactive Surfaces. *Interact. Comput.*, 29 (2): 97-116. doi:10.1093/iwc/iww007
- NAEYC and the Fred Rogers Center (2012). Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8. https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/topics/PS_technology_WEB.pdf
- Nathan, Mitchell J.; Wolfgram, Matthew; Srisurichan, Rachaya; Walkington, Candace; Alibali, Martha W. (2017). Threading mathematics through symbols, sketches, software, silicon, and wood: Teachers produce and maintain cohesion to support STEM integration. *J. Educ. Res.*, 110 (3): 272-293. doi:10.1080/00220671.2017.1287046
- Nemorin, Selena; Selwyn, Neil (2017). Making the best of it? Exploring the realities of 3D printing in school. *Res. Pap. Educ.*, 32 (5): 578-595. doi:10.1080/02671522.2016.1225802
- Neumann, Michelle M. (2014). An examination of touch screen tablets and emergent literacy in Australian pre-school children. *Australian Journal of Education*, 58 (2): 109--122.
- Neumann, Michelle M. (2016). Young children's use of touch screen tablets for writing and reading at home: Relationships with emergent literacy. *Comput. Educ.*, 97: 61-68. doi:10.1016/j.compedu.2016.02.013
- Nevski, Elyna; Siibak, Andra (2016). The role of parents and parental mediation on 0-3-year olds' digital play with smart devices: Estonian parents' attitudes and practices. *Early Years*, 36 (3): 227-241. doi:10.1080/09575146.2016.1161601
- Ng, Oi-Lam; Sinclair, Nathalie (2015). Area Without Numbers: Using Touchscreen Dynamic Geometry to Reason About Shape. *Can. J. Sci. Math. Technol. Educ.*, 15 (1): 84-101. doi:10.1080/14926156.2014.993048
- Nicolete, Priscila Cadorn; Sommer Bilessimo, Simone Meister; da Silva Cristiano, Marta Adriana; Schardosim Simao, Jose Pedro; da Silva, Juarez Bento (2017). Technology Integration Actions in Mathematics teaching in Brazilian Basic Education: Stimulating STEM disciplines. *RED-Rev. Educ. Distancia*, (52): 7. doi:10.6018/red/52/7
- Nieto Moreno de Diezmas, Esther; Dondarza Manzano, Pablo (2016). PLEs in Primary School: The Learners' experience in The Piplep Project. *Digit. Educ. Rev.*, (29): 45-61.
- Nikken, Peter; de Haan, Jos (2015). Guiding young children's internet use at home: Problems that parents experience in their parental mediation and the need for parenting support. *Cyberpsychology*, 9 (1): UNSP 3. doi:10.5817/CP2015-1-3

- Nollen, Nicole L.; Hutcheson, Tresza; Carlson, Susan; Rapoff, Michael; Goggin, Kathy; Mayfield, Carlene; Ellerbeck, Edward (2013). Development and functionality of a handheld computer program to improve fruit and vegetable intake among low-income youth. *Health Educ. Res.*, 28 (2): 249-264. doi:10.1093/her/cys099
- Nose, Yoko; Fujinaga, Rina; Suzuki, Maki; Hayashi, Ikuyo; Moritani, Toshio; Kotani, Kazuhiko; Nagai, Narumi (2017). Association of evening smartphone use with cardiac autonomic nervous activity after awakening in adolescents living in high school dormitories. *Childs Nerv. Syst.*, 33 (4): 653-658. doi:10.1007/s00381-017-3388-z
- Nourish baby (2017). Screen time and kids: What are the Recommendations? <http://www.nourishbaby.com.au/screen-time/>
- Novalic, Fadil; Novalic, Mevljuda; Saracevic, Muzafer; Azizovic, Emrus (2017). The Importance of E-Learning for Homework Assignments in Islamic Religious Instruction in Primary Schools. *Croat. J. Educ.*, 19 (1): 267-303. doi:10.15516/cje.v19i1.2236
- Nusir, Sawsan; Alsmadi, Izzat; Al-Kabi, Mohammed; Sharadgah, Fatima (2012). Studying the Impact of Using Multimedia Interactive Programs at Children Ability to Learn Basic Math Skills. *Acta Didactica Napocensia*, 5 (2): 17--32.
- Nyberg, Gunn; Meckbach, Jane (2017). Exergames "as a teacher" of movement education: exploring knowing in moving when playing dance games in physical education. *Phys. Educ. Sport Pedagog.*, 22 (1): 1-14. doi:10.1080/17408989.2015.1112778
- Nystrom, Christine Delisle; Sandin, Sven; Henriksson, Pontus; Henriksson, Hanna; Trolle-Lagerros, Ylva; Larsson, Christel; Maddison, Ralph; Ortega, Francisco B.; Pomeroy, Jeremy; Ruiz, Jonatan R.; Silfvernagel, Kristin; Timpka, Toomas; Lof, Marie (2017). Mobile-based intervention intended to stop obesity in preschool-aged children: the MINISTOP randomized controlled trial. *American Journal of Clinical Nutrition*, 105 (6): 1327--1335.
- Oakley, Grace; Howitt, Christine; Garwood, Rebekah; Durack, Annie-Rose (2013). Becoming multimodal authors: Pre-service teachers' interventions to support young children with autism. *Aust. J. Early Child.*, 38 (3): 86-96.
- Occupational therapy for children. Screen Time: How to Make it Healthy? <http://occupationaltherapychildren.com.au/screen-time-how-to-make-it-healthy/>
- O'Connor, Jane; Fotakopoulou, Olga (2016). A threat to childhood innocence or the future of learning? Parents' perspectives on the use of touch-screen technology by 0-3 year-olds in the UK. *Contemp. Iss. Early Child.*, 17 (2): 235-247. doi:10.1177/1463949116647290
- Office of the Children's eSafety Commissioner (2017). Balancing online time. <https://www.esafety.gov.au/esafety-information/esafety-issues/balancing-online-time>
- Office of the Children's eSafety Commissioner (2017). How much is too much? <https://esafety.gov.au/education-resources/iparent/staying-safe/balancing-time-online/how-much-is-too-much>
- Office of the eSafety Commissioner. Managing online time. <https://www.esafety.gov.au/education-resources/iparent/staying-safe/balancing-time-online/managing-online-time>
- Oi-Lam Ng; Sinclair, Nathalie (2015). Young children reasoning about symmetry in a dynamic geometry environment. *ZDM-Int. J. Math. Educ.*, 47 (3): 421-434. doi:10.1007/s11858-014-0660-5
- Ojanen, Emma; Ronimus, Miia; Ahonen, Timo; Chansa-Kabali, Tamara; February, Pamela; Jere-Folotiya, Jacqueline; Kauppinen, Karri-Pekka; Ketonen, Ritva; Ngorosho, Damaris; Pitkanen, Mikko; Puhakka, Suzanne; Sampa, Francis; Walubita, Gabriel; Yalukanda, Christopher; Pugh, Ken; Richardson, Ulla; Serpell, Robert; Lyytinen, Heikki (2015). GraphoGame - a catalyst for multi-level promotion of literacy in diverse contexts. *Front. Psychol.*, 6: 671. doi:10.3389/fpsyg.2015.00671
- Olmedo-Vizueta, Diana; Hernandez-Ambato, Jorge; Avila-Pesantez, Diego; Bilotta, Eleonora; Pantano, Pietro (2017). VALE-Emotions: Teaching mobile application for individuals with Autism Spectrum Disorders. *Enfoque UTE*, 8: 358-373.

- O'Loughlin, Joe; Ni Chroinin, Deirdre; O'Grady, David (2013). Digital video: The impact on children's learning experiences in primary physical education. *Eur. Phys. Educ. Rev.*, 19 (2): 165-182. doi:10.1177/1356336X13486050
- Oman, Anne; Hashemi, Sylvana Sofkova (2015). Design and Redesign of a Multimodal Classroom Task - Implications for Teaching and Learning. *J. Inf. Technol. Educ.-Res.*, 14: 139-159.
- OPAL (2011). Give the screen a rest, active play is best. <http://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/healthy+living/healthy+communities/local+community/opal/opal+themes/give+the+screen+a+rest.+active+play+is+best>
- Optometry Australia (2016). Blue light guidelines coming.
- Osman, Aznoora; Yahaya, Wan Ahmad Jaafar Wan; Ahmad, Aznan Che (2015). Educational Multimedia App for Dyslexia Literacy Intervention: A Preliminary Evaluation. *Procedia - Social and Behavioral Sciences*, 176: 405--411.
- Ott, Michela; Pozzi, Francesca (2012). Digital games as creativity enablers for children. *Behav. Inf. Technol.*, 31 (10): 1011-1019. doi:10.1080/0144929X.2010.526148
- Outhwaite, Laura A.; Gulliford, Anthea; Pitchford, Nicola J. (2017). Closing the gap: Efficacy of a tablet intervention to support the development of early mathematical skills in UK primary school children. *Comput. Educ.*, 108: 43-58. doi:10.1016/j.compedu.2017.01.011
- Owston, Ron; Wideman, Herb; Ronda, Natalia Sinitskaya; Brown, Christine (2009). Computer game development as a literacy activity. *Comput. Educ.*, 53 (3): 977-989. doi:10.1016/j.compedu.2009.05.015
- Ozdamli, Fezile; Tavukcu, Tahir (2016). Determination of Secondary School Students' Attitudes towards Tablet PC Supported Education. *J. Univers. Comput. Sci.*, 22 (1): 4-15.
- Ozerbas, Mehmet Arif; Erdogan, Bilge Has (2016). The Effect of the Digital Classroom on Academic Success and Online Technologies Self-Efficacy. *Educ. Technol. Soc.*, 19 (4): 203-212.
- Paciga, Kathleen A. (2015). Their teacher can't be an app: Preschoolers' listening comprehension of digital storybooks. *J. Early Child. Lit.*, 15 (4): 473-509. doi:10.1177/1468798414552510
- Padiotis, Ioannis; Mikropoulos, Tassos A. (2010). Using SOLO to Evaluate an Educational Virtual Environment in a Technology Education Setting. *Educ. Technol. Soc.*, 13 (3): 233-245.
- Page, A; Cooper, A; Griew, P Jago, R. (2010). Children's Screen Viewing is Related to Psychological Difficulties Irrespective of Physical Activity. *Pediatrics* 126 (5).
- Palmer, Hanna (2015). Using tablet computers in preschool: How does the design of applications influence participation, interaction and dialogues? *Int. J. Early Years Educ.*, 23 (4): 365-381. doi:10.1080/09669760.2015.1074553
- Palmer, Kristy; Ciccarelli, Marina; Falkmer, Torbjorn; Parsons, Richard (2014). Associations between exposure to Information and Communication Technology (ICT) and reported discomfort among adolescents. *Work: A Journal of Prevention Assessment & Rehabilitation*, 48 (2): 165--173.
- Panoutsopoulos, Hercules; Sampson, Demetrios G. (2012). A Study on Exploiting Commercial Digital Games into School Context. *Educ. Technol. Soc.*, 15 (1): 15-27.
- Papastergiou, Marina (2009). Digital Game-Based Learning in high school Computer Science education: Impact on educational effectiveness and student motivation. *Comput. Educ.*, 52 (1): 1-12. doi:10.1016/j.compedu.2008.06.004
- Papathomas, Pelagia; Goldschmidt, Karen (2017). Utilizing virtual reality and immersion video technology as a focused learning tool for children with autism spectrum disorder. *J. Pediatr. Nurs.*, 35: 8-9. doi:10.1016/j.pedn.2017.01.013
- Parent, Justin; Sanders, Wesley; Forehand, Rex (2016). Youth Screen Time and Behavioral Health Problems: The Role of Sleep Duration and Disturbances. *J. Dev. Behav. Pediatr.*, 37 (4): 277-284.
- Park, Joonkoo; Bermudez, Vanessa; Roberts, Rachel C.; Brannon, Elizabeth M. (2016). Non-symbolic approximate arithmetic training improves math performance in preschoolers. *J. Exp. Child Psychol.*, 152: 278-293. doi:10.1016/j.jecp.2016.07.011

- Park, Sung Youl; Kim, Soo-Wook; Cha, Seung-Bong; Nam, Min-Woo (2014). Comparing learning outcomes of video-based e-learning with face-to-face lectures of agricultural engineering courses in Korean agricultural high schools. *Interact. Learn. Environ.*, 22 (4): 418-428. doi:10.1080/10494820.2012.680967
- Parsons, David; Adhikari, Janak (2016). Bring Your Own Device to Secondary School: The Perceptions of Teachers, Students and Parents. *Electron. J. E-Learn.*, 14 (1).
- Parton, Becky Sue; Hancock, Robert; Crain-Dorough, Mindy; Oescher, Jeff (2009). Interactive Media to Support Language Acquisition for Deaf Students. *Journal on School Educational Technology*, 5 (1): 17--24.
- Passig, David; Schwartz, Timor (2014). Solving Conceptual and Perceptual Analogies With Virtual Reality Among Kindergarten Children of Immigrant Families. *Teach. Coll. Rec.*, 116 (2): 20302.
- Passig, David; Tzuriel, David; Eshel-Kedmi, Ganit (2016). Improving children's cognitive modifiability by dynamic assessment in 3D Immersive Virtual Reality environments. *Comput. Educ.*, 95: 296-308. doi:10.1016/j.compedu.2016.01.009
- Patchan, Melissa M.; Puranik, Cynthia S. (2016). Using tablet computers to teach preschool children to write letters: Exploring the impact of extrinsic and intrinsic feedback. *Comput. Educ.*, 102: 128-137. doi:10.1016/j.compedu.2016.07.007
- Patera, Marianne; Draper, Steve; Naef, Martin (2008). Exploring Magic Cottage: a virtual reality environment for stimulating children's imaginative writing. *Interact. Learn. Environ.*, 16 (3): 245-263. doi:10.1080/10494820802114093
- Pedersen, Scott J.; Cooley, Paul D.; Cruickshank, Vaughan J. (2017). Caution regarding exergames: a skill acquisition perspective. *Phys. Educ. Sport Pedagog.*, 22 (3): 246-256. doi:10.1080/17408989.2016.1176131
- Perez-Marin, Diana; Pascual-Nieto, Ismael (2013). An exploratory study on how children interact with pedagogic conversational agents. *Behav. Inf. Technol.*, 32 (9): 955-964. doi:10.1080/0144929X.2012.687774
- Perry, David R.; Steck, Andy K. (2015). Increasing Student Engagement, Self-Efficacy, and Meta-Cognitive Self-Regulation in the High School Geometry Classroom: Do iPads Help? *Comput. Sch.*, 32 (2): 122-143. doi:10.1080/07380569.2015.1036650
- Piatt, Carley; Coret, Marian; Choi, Michael; Volden, Joanne; Bisanz, Jeffrey (2016). Comparing Children's Performance on and Preference for a Number-Line Estimation Task: Tablet Versus Paper and Pencil. *J. Psychoeduc. Assess.*, 34 (3): 244-255. doi:10.1177/0734282915594746
- Picard, Delphine; Martin, Perrine; Tsao, Raphaela (2014). iPads at School? A Quantitative Comparison of Elementary Schoolchildren's Pen-on-Paper Versus Finger-on-Screen Drawing Skills. *Journal of Educational Computing Research*, 50 (2): 203--212.
- Pike, Pamela D. (2017). Improving music teaching and learning through online service: A case study of a synchronous online teaching internship. *Int. J. Music Educ.*, 35 (1): 107-117. doi:10.1177/0255761415613534
- Piquette, Noeha A.; Savage, Robert S.; Abrami, Philip C. (2014). A cluster randomized control field trial of the ABRACADABRA web-based reading technology: replication and extension of basic findings. *Front. Psychol.*, 5: 1413. doi:10.3389/fpsyg.2014.01413
- Pitchford, Nicola J. (2015). Development of early mathematical skills with a tablet intervention: a randomized control trial in Malawi. *Front. Psychol.*, 6: 485. doi:10.3389/fpsyg.2015.00485
- Polos, Peter G.; Bhat, Sushanth; Gupta, Divya; O'Malley, Richard J.; DeBari, Vincent A.; Upadhyay, Hinesh; Chaudhry, Saqib; Nimma, Anitha; Pinto-Zipp, Genevieve; Chokroverty, Sudhansu (2015). The impact of Sleep Time-Related Information and Communication Technology (STRICT) on sleep patterns and daytime functioning in American adolescents. *J. Adolesc.*, 44: 232-244. doi:10.1016/j.adolescence.2015.08.002
- Pope, Zachary; Chen, Senlin; Pasco, Denis; Gao, Zan (2016). Effects of Body Mass Index on Children's Physical Activity Levels in School-Based "Dance Dance Revolution". *Games Health J.*, 5 (3): 183-188. doi:10.1089/g4h.2015.0098

- Preradovic, Nives Mikelic; Lesin, Gordana; Boras, Damir (2016). Introduction of Digital Storytelling in Preschool Education: a Case Study from Croatia. *Digit. Educ. Rev.*, (30): 94-105.
- Preston, Jane P.; Moffatt, Lyndsay; Wiebe, Sean; McAuley, Alexander; Campbell, Barbara; Gabriel, Martha (2015). The use of technology in Prince Edward Island (Canada) high schools: Perceptions of school leaders. *Educ. Manag. Adm. Leadersh.*, 43 (6): 989-1005.
doi:10.1177/1741143214535747
- Prevention Research Collaboration (2011). Position Statement on Children and Young People's Screen Time as a Health Concern. http://sydney.edu.au/medicine/public-health/prevention-research/pdf/PP_screentime_0711.pdf
- Price, Sara; Falcao, Taciana Pontual (2011). Where the attention is: Discovery learning in novel tangible environments. *Interact. Comput.*, 23 (5): 499-512. doi:10.1016/j.intcom.2011.06.003
- Prieto, Linda; Arreguin-Anderson, Maria G.; Yuen, Timothy T.; Ek, Lucila D.; Sanchez, Patricia; Machado-Casas, Margarita; Garcia, Adriana (2016). Four cases of a sociocultural approach to mobile learning in La Clase Magica, an afterschool technology club. *Interact. Learn. Environ.*, 24 (2): 345-356. doi:10.1080/10494820.2015.1113711
- Proctor, C. Patrick; Dalton, Bridget; Uccelli, Paola; Biancarosa, Gina; Mo, Elaine; Snow, Catherine; Neugebauer, Sabina (2011). Improving comprehension online: effects of deep vocabulary instruction with bilingual and monolingual fifth graders. *Reading and Writing*, 24 (5): 517--544.
- Pruet, Putjorn; Ang, Chee Siang; Farzin, Deravi (2016). Understanding tablet computer usage among primary school students in underdeveloped areas: Students' technology experience, learning styles and attitudes. *Comput. Hum. Behav.*, 55: 1131-1144. doi:10.1016/j.chb.2014.09.063
- Psycharis, Sarantos; Chalatzoglidis, Georgios; Kalogiannakis, Michail (2013). Moodle as a Learning Environment in Promoting Conceptual Understanding for Secondary School Students. *Eurasia J. Math. Sci. Technol. Educ.*, 9 (1): 11-21.
- Punamaki, Raija-Leena; Wallenius, Marjut; Nygard, Clase-Hakan; Saarni, Lea; Rimpela, Aria (2007). Use of information and communication technology (ICT) and perceived health in adolescence: The role of sleeping habits and waking-time tiredness. *J. Adolesc.*, 30 (4): 569-585.
doi:10.1016/j.adolescence.2006.07.004
- Purba, Siska Wati Dewi; Hwang, Wu-Yuin (2017). Investigation of Learning Behaviors and Achievement of Vocational High School Students Using an Ubiquitous Physics Tablet PC App. *J. Sci. Educ. Technol.*, 26 (3): 322-331. doi:10.1007/s10956-016-9681-x
- Radesky, Jenny S.; Eisenberg, Staci; Kistin, Caroline J.; Gross, Jamie; Block, Gabrielle; Zuckerman, Barry; Silverstein, Michael (2016). Overstimulated Consumers or Next-Generation Learners? Parent Tensions About Child Mobile Technology Use. *Ann. Fam. Med.*, 14 (6): 503-508.
doi:10.1370/afm.1976
- Raes, Annelies; Schellens, Tammy; De Wever, Bram; Vanderhoven, Ellen (2012). Scaffolding information problem solving in web-based collaborative inquiry learning. *Comput. Educ.*, 59 (1): 82-94. doi:10.1016/j.compedu.2011.11.010
- Raising Children (2017). Healthy screen time and quality media choices: 2-5 years. http://raisingchildren.net.au/articles/screen_time_2-5_years.html
- Raising Children (2006-2017). Media benefits for children and teenagers. http://raisingchildren.net.au/articles/media_benefits.html/context/760
- Rajanna, Shyam Hanumanapura; Sharma, Manoj Kumar; Palanichamy, Thamil Selvan (2016). Exploration of Technology Use Pattern Among Teenagers and its Relationship With Psychological Variables. *ASEAN J. Psychiatr.*, 17 (2): 239-249.
- Ranieri, Maria; Bruni, Isabella (2013). Mobile storytelling and informal education in a suburban area: a qualitative study on the potential of digital narratives for young second-generation immigrants. *Learn. Media Technol.*, 38 (2): 217-235. doi:10.1080/17439884.2013.724073
- Rap, Shelley; Blonder, Ron (2017). Thou shall not try to speak in the Facebook language: Students' perspectives regarding using Facebook for chemistry learning. *Comput. Educ.*, 114: 69-78.
doi:10.1016/j.compedu.2017.06.014

- Rappolt-Schlichtmann, Gabrielle; Daley, Samantha G.; Lim, Seoin; Lapinski, Scott; Robinson, Kristin H.; Johnson, Mindy (2013). Universal Design for Learning and Elementary School Science: Exploring the Efficacy, Use, and Perceptions of a Web-Based Science Notebook. *J. Educ. Psychol.*, 105 (4): 1210-1225. doi:10.1037/a0033217
- Rau, Pei-Luen Patrick; Gao, Qin; Wu, Li-Mei (2008). Using mobile communication technology in high school education: Motivation, pressure, and learning performance. *Comput. Educ.*, 50 (1): 1-22. doi:10.1016/j.compedu.2006.03.008
- Reeves, Jennifer L.; Gunter, Glenda A.; Lacey, Candace (2017). Mobile Learning in Pre-Kindergarten: Using Student Feedback to Inform Practice. *Educ. Technol. Soc.*, 20 (1): 37-44.
- Regtvoort, Anne; Zijlstra, Haytske; van der Leij, Aryan (2013). The Effectiveness of a 2-year Supplementary Tutor-assisted Computerized Intervention on the Reading Development of Beginning Readers at Risk for Reading Difficulties: A Randomized Controlled Trial. *Dyslexia*, 19 (4): 256-280. doi:10.1002/dys.1465
- Reilly J. J. (2010). Physical Activity Recommendations for Birth-18 Years in the UK. www.paha.org.uk/File/Index/d6945a31-a6a5-4d33-b14f-9d2d0109a56a
- Reis Silva, Georgia Rodrigues; Rodarti Pitangui, Ana Carolina; Andrade Xavier, Michele Katherine; Valois Correia-Junior, Marco Aurelio; De Araujo, Rodrigo Cappato (2016). Prevalence of musculoskeletal pain in adolescents and association with computer and videogame use. *J. Pediatr.*, 92 (2): 188-196. doi:10.1016/j.jpmed.2015.06.006
- Revilla Munoz, Olga; Alpiste Penalba, Francisco; Fernandez Sanchez, Joaquin; Santos, Olga C. (2017). Reducing techno-anxiety in high school teachers by improving their ICT problem-solving skills. *Behav. Inf. Technol.*, 36 (3): 255-268. doi:10.1080/0144929X.2016.1221462
- Richter, Anna; Courage, Mary L. (2017). Comparing electronic and paper storybooks for preschoolers: Attention, engagement, and recall. *J. Appl. Dev. Psychol.*, 48: 92-102. doi:10.1016/j.appdev.2017.01.002
- Rickard, Natalie A.; Smales, Caroline J.; Rickard, Kurt L. (2013). A computer-based auditory sequential pattern test for school-aged children. *Int. J. Pediatr. Otorhinolaryngol.*, 77 (5): 838-842. doi:10.1016/j.ijporl.2013.02.024
- Riconscente, Michelle M. (2013). Results From a Controlled Study of the iPad Fractions Game Motion Math. *Games Cult.*, 8 (4): 186-214. doi:10.1177/1555412013496894
- Robert, Maxime; Ballaz, Laurent; Hart, Raphael; Lemay, Martin (2013). Exercise Intensity Levels in Children With Cerebral Palsy While Playing With an Active Video Game Console. *Phys. Ther.*, 93 (8): 1084-1091. doi:10.2522/ptj.20120204
- Ronimus, Miia; Kujala, Janne; Tolvanen, Askko; Lyytinen, Heikki (2014). Children's engagement during digital game-based learning of reading: The effects of time, rewards, and challenge. *Comput. Educ.*, 71: 237-246. doi:10.1016/j.compedu.2013.10.008
- Ronimus, Miia; Richardson, Ulla (2014). Digital game-based training of early reading skills: overview of the GraphoGame method in a highly transparent orthography. *Estud. Psicol.*, 35 (3): 648-661. doi:10.1080/02109395.2014.974424
- Roseberry, Sarah; Hirsh-Pasek, Kathy; Golinkoff, Roberta M. (2014). Skype Me! Socially Contingent Interactions Help Toddlers Learn Language. *Child Dev.*, 85 (3): 956-970. doi:10.1111/cdev.12166
- Roskos, Kathleen A.; Sullivan, Shannon; Simpson, Danielle; Zuzolo, Nicole (2016). E-Books in the Early Literacy Environment: Is There Added Value for Vocabulary Development? *J. Res. Child. Educ.*, 30 (2): 226-236. doi:10.1080/02568543.2016.1143895
- Ross, Kirsty M.; Pye, Rachel E.; Randell, Jordan (2016). Reading Touch Screen Storybooks with Mothers Negatively Affects 7-Year-Old Readers' Comprehension but Enriches Emotional Engagement. *Front. Psychol.*, 7: 1728. doi:10.3389/fpsyg.2016.01728
- Roth, Vicki; Ivanchenko, Volodymyr; Record, Nicholas (2008). Evaluating student response to WeBWork, a web-based homework delivery and grading system. *Comput. Educ.*, 50 (4): 1462-1482. doi:10.1016/j.compedu.2007.01.005

- Rowe, Elizabeth; Asbell-Clarke, Jodi; Baker, Ryan S.; Eagle, Michael; Hicks, Andrew G.; Barnes, Tiffany M.; Brown, Rebecca A.; Edwards, Teon (2017). Assessing implicit science learning in digital games. *Computers in Human Behavior*, 1--14.
- Rubino, Irene; Barberis, Claudia; Xhembulla, Jetmir; Malnati, Giovanni (2015). Integrating a Location-Based Mobile Game in the Museum Visit: Evaluating Visitors' Behaviour and Learning. *ACM J. Comput. Cult. Herit.*, 8 (3). doi:10.1145/2724723
- Ruchter, Markus; Klar, Bernhard; Geiger, Werner (2010). Comparing the effects of mobile computers and traditional approaches in environmental education. *Computers & Education*, 54 (4): 1054--1067.
- Russ, Shirley A.; Larson, Kandyce; Franke, Todd Michael; Halfon, Neal (2009). Associations Between Media Use and Health in US Children. *Academic Pediatrics*, 9 (5): 300--306.
- Russo-Johnson, Colleen; Troseth, Georgene; Duncan, Charlotte; Mesghina, Almaz (2017). All Tapped Out: Touchscreen Interactivity and Young Children's Word Learning. *Front. Psychol.*, 8: 578. doi:10.3389/fpsyg.2017.00578
- Sad, Suleyman Nihat; Konca, Ahmet Sami; Ozer, Niyazi; Acar, Feride (2016). Parental e-nvolvement: a phenomenological research on electronic parental involvement. *International Journal of Pedagogies & Learning*, 11 (2): 163--186.
- Sampasa-Kanyinga, Hugues; Chaput, Jean-Philippe (2016). Use of Social Networking Sites and Adherence to Physical Activity and Screen Time Recommendations in Adolescents. *J. Phys. Act. Health*, 13 (5): 474-480. doi:10.1123/jpah.2015-0343
- Sanders L (2016). Screen time guidelines for kids give parents the controls. *Science News*. <https://www.sciencenews.org/blog/growth-curve/screen-time-guidelines-kids-give-parents-controls>
- Sarica, Hatice Ciralı; Usluel, Yasemin Kocak (2016). The effect of digital storytelling on visual memory and writing skills. *Comput. Educ.*, 94: 298-309. doi:10.1016/j.compedu.2015.11.016
- Sasi, Sabri; Chang, Maiga; Altinay-Aksal, Fahriye; Kayimbasioglu, Dervis; Haci, Huseyin; Kinshuk; Altinay-Gazi, Zehra (2017). Technology Enhanced Instruction: An Example of English Language Learning in the Context of Peace. *Eurasia J. Math. Sci. Technol. Educ.*, 13 (6): 1605-1614. doi:10.12973/eurasia.2017.00687a
- Scanlon, Eileen; Woods, Will; Clow, Doug (2014). Informal Participation in Science in the UK: Identification, Location and Mobility with iSpot. *Educational Technology & Society*, 17 (2): 58--71.
- Schacter, John; Jo, Booil (2016). Improving low-income preschoolers mathematics achievement with Math Shelf, a preschool tablet computer curriculum. *Comput. Hum. Behav.*, 55: 223-229. doi:10.1016/j.chb.2015.09.013
- Schilhab, Theresa (2017). Impact of iPads on break-time in primary schools: A Danish context. *Oxf. Rev. Educ.*, 43 (3): 261-275. doi:10.1080/03054985.2017.1304920
- Schneps, Matthew H.; Ruel, Jonathan; Sonnert, Gerhard; Dussault, Mary; Griffin, Michael; Sadler, Philip M. (2014). Conceptualizing astronomical scale: Virtual simulations on handheld tablet computers reverse misconceptions. *Comput. Educ.*, 70: 269-280. doi:10.1016/j.compedu.2013.09.001
- Schoenfelder, Mona L.; Bogner, Franz X. (2017). Two ways of acquiring environmental knowledge: by encountering living animals at a beehive and by observing bees via digital tools. *Int. J. Sci. Educ.*, 39 (6): 723-741. doi:10.1080/09500693.2017.1304670
- School a to z. Screen Time. <http://www.schoolatoz.nsw.edu.au/technology/using-technology/screen-time>
- Schrader, Claudia; Bastiaens, Theo J. (2012). The influence of virtual presence: Effects on experienced cognitive load and learning outcomes in educational computer games. *Computers in Human Behavior*, 28 (2): 648--658.
- Schroeder, Elizabeth L.; Kirkorian, Heather L. (2016). When Seeing Is Better than Doing: Preschoolers' Transfer of STEM Skills Using Touchscreen Games. *Front. Psychol.*, 7: 1377. doi:10.3389/fpsyg.2016.01377

- Schwebel, David C.; McClure, Leslie A. (2010). Using virtual reality to train children in safe street-crossing skills. *Inj. Prev.*, 16 (1): E1-E5. doi:10.1136/ip.2009.025288
- Schwebel, David C.; McClure, Leslie A.; Severson, Joan (2014). Teaching Children to Cross Streets Safely: A Randomized, Controlled Trial. *Health Psychol.*, 33 (7): 628-638. doi:10.1037/hea0000032
- Schweizer, Angelick; Berchtold, Andre; Barrense-Dias, Yara; Akre, Christina; Suris, Joan-Carles (2017). Adolescents with a smartphone sleep less than their peers. *Eur. J. Pediatr.*, 176 (1): 131-136. doi:10.1007/s00431-016-2823-6
- ScienceDaily (2016). New recommendations for children's electronic media use. <https://www.sciencedaily.com/releases/2016/10/161021121843.htm>
- Seaman, A (2016). Docs lay out media recommendations for kids, teens. <https://www.reuters.com/article/us-health-pediatrics-media/docs-lay-out-media-recommendations-for-kids-teens-idUSKCN12L1WP>
- Seo, Hogeun; Lee, Claire Shinhea (2017). Emotion Matters: What Happens Between Young Children and Parents in a Touchscreen World. *Int. J. Commun.*, 11: 561-580.
- Seo, You-Jin; Woo, Honguk (2010). The identification, implementation, and evaluation of critical user interface design features of computer-assisted instruction programs in mathematics for students with learning disabilities. *Computers & Education*, 55 (1): 363--377.
- Seomun, GyeongAe; Lee, Jung-Ah; Kim, Eun-Young; Im, MeeYoung; Kim, Miran; Park, Sun-A; Lee, Youngjin (2013). Health Effects of Digital Textbooks on School-Age Children: A Grounded Theory Approach. *West. J. Nurs. Res.*, 35 (9): 1184-1204. doi:10.1177/0193945913491838
- Shadiev, Rustam; Hwang, Wu-Yuin; Huang, Yueh-Min; Liu, Tzu-Yu (2015). The Impact of Supported and Annotated Mobile Learning on Achievement and Cognitive Load. *Educ. Technol. Soc.*, 18 (4): 53-69.
- Shadiev, Rustam; Hwang, Wu-Yuin; Huang, Yueh-Min; Liu, Tzu-Yu (2017). Cognitive Diffusion Model: Facilitating EFL Learning in an Authentic Environment. *IEEE Trans. Learn. Technol.*, 10 (2): 168-181. doi:10.1109/TLT.2016.2574356
- Shamir, Adina; Korat, Ofra (2015). Educational Electronic Books for Supporting Emergent Literacy of Kindergarteners At-Risk for Reading Difficulties-What Do We Know So Far? *Comput. Sch.*, 32 (2): 105-121. doi:10.1080/07380569.2015.1027868
- Shamir, Adina; Korat, Ofra; Fella, Renat (2012). Promoting vocabulary, phonological awareness and concept about print among children at risk for learning disability: can e-books help? *Read. Writ.*, 25 (1): 45-69. doi:10.1007/s11145-010-9247-x
- Shamir, Adina; Lifshitz, Irit (2013). E-Books for supporting the emergent literacy and emergent math of children at risk for learning disabilities: can metacognitive guidance make a difference? *Eur. J. Spec. Needs Educ.*, 28 (1): 33-48. doi:10.1080/08856257.2012.742746
- Shamir, Adina; Shlafer, Inessa (2011). E-books effectiveness in promoting phonological awareness and concept about print: A comparison between children at risk for learning disabilities and typically developing kindergarteners. *Comput. Educ.*, 57 (3): 1989-1997. doi:10.1016/j.compedu.2011.05.001
- Shamir-Inbal, Tamar; Blau, Ina (2017). Which Pedagogical Parameters Predict the General Quality of ICT Integration from the Perspective of Elementary School Leaders? *Comput. Sch.*, 34 (3): 168-191. doi:10.1080/07380569.2017.1347427
- Shanahan, Lynn E.; Roof, Lisa M. (2013). Developing strategic readers: a multimodal analysis of a primary school teacher's use of speech, gesture and artefacts. *Literacy*, 47 (3): 157-164. doi:10.1111/lit.12002
- Sharif, Iman; Wills, Thomas A.; Sargent, James D. (2010). Effect of Visual Media Use on School Performance: A Prospective Study. *The Journal of adolescent health: official publication of the Society for Adolescent Medicine*, 46 (1): 52.
- Shegog, Ross; Rushing, Stephanie Craig; Gorman, Gwenda; Jessen, Cornelia; Torres, Jennifer; Lane, Travis L.; Gaston, Amanda; Revels, Taija Koogee; Williamson, Jennifer; Peskin, Melissa F.; D'Cruz, Jina; Tortolero, Susan; Markham, Christine M. (2017). NATIVE-It's Your Game: Adapting a

- Technology-Based Sexual Health Curriculum for American Indian and Alaska Native youth. *J. Prim. Prev.*, 38 (42767): 27-48. doi:10.1007/s10935-016-0440-9
- Shih, Ju-Ling; Chu, Hui-Chun; Hwang, Gwo-Jen; Kinshuk (2011). An investigation of attitudes of students and teachers about participating in a context-aware ubiquitous learning activity. *Br. J. Educ. Technol.*, 42 (3): 373-394. doi:10.1111/j.1467-8535.2009.01020.x
- Shin, Min-Sup; Jeon, Hyejin; Kim, Miyoung; Hwang, Taeho; Oh, Seo Jin; Hwangbo, Minsu; Kim, Ki Joong (2016). Effects of Smart-Tablet-Based Neurofeedback Training on Cognitive Function in Children with Attention Problems. *J. Child Neurol.*, 31 (6): 750-760. doi:10.1177/0883073815620677
- Simmons, Elizabeth Schoen; Paul, Rhea; Shic, Frederick (2016). Brief Report: A Mobile Application to Treat Prosodic Deficits in Autism Spectrum Disorder and Other Communication Impairments: A Pilot Study. *Journal of Autism and Developmental Disorders*, 46 (1): 320--327.
- Simons, Monique; Chinapaw, Mai J. M.; van de Bovenkamp, Maaïke; de Boer, Michiel R.; Seidell, Jacob C.; Brug, Johannes; de Vet, Emely (2014). Active video games as a tool to prevent excessive weight gain in adolescents: rationale, design and methods of a randomized controlled trial. *BMC Public Health*, 14: 275. doi:10.1186/1471-2458-14-275
- Sinclair, Nathalie; Chorney, Sean; Rodney, Sheree (2016). Rhythm in number: exploring the affective, social and mathematical dimensions of using TouchCounts. *Math. Educ. Res. J.*, 28 (1): 31-51. doi:10.1007/s13394-015-0154-y
- Slussareff, Michaela; Bohackova, Petra (2016). Students as Game Designers vs. 'Just' Players: Comparison of Two Different Approaches to Location-Based Games Implementation into School Curricula. *Digit. Educ. Rev.*, (29): 284-297.
- Smeets, D. J. H.; Bus, A. G. (2015). The interactive animated e-book as a word learning device for kindergartners. *Appl. Psycholinguist.*, 36 (4): 899-920. doi:10.1017/S0142716413000556
- Smeets, Daisy J. H.; Bus, Adriana G. (2012). Interactive electronic storybooks for kindergartners to promote vocabulary growth. *J. Exp. Child Psychol.*, 112 (1): 36-55. doi:10.1016/j.jecp.2011.12.003
- Smeets, Daisy J. H.; van Dijken, Marianne J.; Bus, Adriana G. (2014). Using Electronic Storybooks to Support Word Learning in Children With Severe Language Impairments. *J. Learn. Disabil.*, 47 (5): 435-449. doi:10.1177/0022219412467069
- Smith, Blaine E.; Shen, Ji (2017). Scaffolding Digital Literacies for Disciplinary Learning: Adolescents Collaboratively Composing Multimodal Science Fictions. *J. Adolesc. Adult Lit.*, 61 (1): 85-90. doi:10.1002/jaal.660
- Smith, Katherine A.; Ayres, Kevin A.; Alexander, Jennifer; Ledford, Jennifer R.; Shepley, Collin; Shepley, Sally B. (2016). Initiation and Generalization of Self-Instructional Skills in Adolescents with Autism and Intellectual Disability. *J. Autism Dev. Disord.*, 46 (4): 1196-1209. doi:10.1007/s10803-015-2654-8
- Smith, Shana; Ericson, Emily (2009). Using immersive game-based virtual reality to teach fire-safety skills to children. *Virtual Real.*, 13 (2): 87-99. doi:10.1007/s10055-009-0113-6
- Solak, Ekrem; Cakir, Recep (2016). Investigating the Role of Augmented Reality Technology in the Language Classroom. *Croat. J. Educ.*, 18 (4): 1067-1077. doi:10.15516/cje.v18i4.1729
- Sommerich, C. M.; Ward, R.; Sikdar, K.; Payne, J.; Herman, L. (2007). A survey of high school students with ubiquitous access to tablet PCs. *Ergonomics*, 50 (5): 706-727. doi:10.1080/00140130701194793
- Song, Yanjie; Wong, Lung-Hsiang; Looi, Chee-Kit (2012). Fostering personalized learning in science inquiry supported by mobile technologies. *Educ. Tech. Res. Dev.*, 60 (4): 679-701. doi:10.1007/s11423-012-9245-6
- Sormunen, Marjorita; Miettinen, Hanna (2017). Health behavior tracking via mobile games: A case study among school-aged children. *Cogent Education*, 4.
- Soury-Lavergne, Sophie; Maschietto, Michela (2015). Articulation of spatial and geometrical knowledge in problem solving with technology at primary school. *ZDM-Int. J. Math. Educ.*, 47 (3): 435-449. doi:10.1007/s11858-015-0694-3

- Stacy, Sara T.; Cartwright, Macey; Arwood, Zjanya; Canfield, James P.; Kloos, Heidi (2017). Addressing the Math-Practice Gap in Elementary School: Are Tablets a Feasible Tool for Informal Math Practice? *Front. Psychol.*, 8: 179. doi:10.3389/fpsyg.2017.00179
- Staiano, Amanda E.; Beyl, Robbie A.; Hsia, Daniel S.; Katzmarzyk, Peter T.; Newton, Robert L., Jr. (2017). Twelve weeks of dance exergaming in overweight and obese adolescent girls: Transfer effects on physical activity, screen time, and self-efficacy. *J. Sport Health Sci.*, 6 (1): 4-10. doi:10.1016/j.jshs.2016.11.005
- Stieler-Hunt, Colleen; Jones, Christian (2015). Educators who believe: understanding the enthusiasm of teachers who use digital games in the classroom. *Res. Learn. Technol.*, 23 (1): 26155. doi:10.3402/rlt.v23.26155
- Stoyanova, D.; Kafadarova, N.; Stoyanova-Petrova, S. (2015). Enhancing elementary student learning in natural sciences through mobile augmented reality technology. *Bulg. Chem. Commun.*, 47: 533-537.
- Straker L, Howie E, Smith A, Jensen L, Piek J, Campbell A. (2015). A crossover randomised and controlled trial of the impact of active video games on motor coordination and perceptions of physical ability in children at risk of Developmental Coordination Disorder. *Hum Mov Sci.* 42:146-60. doi: 10.1016/j.humov.2015.04.011.
- Straker L, Maslen B, Burgess-Limerick R, Pollock C. (2009). Children have less variable postures and muscle activities when using new electronic information technology compared with old paper-based information technology. *J Electromyogr Kinesiol.* 19(2): e132-43. doi: 10.1016/j.jelekin.2007.11.011
- Straker Leon, Anne Smith, Beth Hands, Tim Olds and Rebecca Abbott (2013) Screen-based media use clusters are related to other activity behaviours and health indicators in adolescents. *BMC Public Health*, 13:1174. doi.org/10.1186/1471-2458-13-1174
- Straker, L. M.; Coleman, J.; Skoss, R.; Maslen, B. A.; Burgess-Limerick, R.; Pollock, C. M. (2008). A comparison of posture and muscle activity during tablet computer, desktop computer and paper use by young children. *Ergonomics*, 51 (4): 540-555. doi:10.1080/00140130701711000
- Straker, Leon M, Rebecca A Abbott, and Anne J Smith. (2013). To Remove or to Replace Traditional Electronic Games? A Crossover Randomised Controlled Trial on the Impact of Removing or Replacing Home Access to Electronic Games on Physical Activity and Sedentary Behaviour in Children Aged 10–12 Years. *BMJ Open* 3.6: e002629.
- Strouse, Gabrielle A.; Ganea, Patricia A. (2017). Parent-Toddler Behavior and Language Differ When Reading Electronic and Print Picture Books. *Front. Psychol.*, 8: 677. doi:10.3389/fpsyg.2017.00677
- Strouse, Gabrielle A.; Ganea, Patricia A. (2017). Toddlers' word learning and transfer from electronic and print books. *J. Exp. Child Psychol.*, 156: 129-142. doi:10.1016/j.jecp.2016.12.001
- Struempfer, Barb; Parmer, Sondra M.; Funderburk, Katherine (2016). Use of Blended Learning to Improve Nutrition Knowledge in Third-Graders.. *Journal of Nutrition Education & Behavior*, 48 (7): 510--511.e1.
- Sugimoto G (2017). Screen Time Guidelines for Young Children. Kaiser permanente.
- Sun, Haichun (2012). Exergaming Impact on Physical Activity and Interest in Elementary School Children. *Res. Q. Exerc. Sport*, 83 (2): 212-220.
- Sun, Haichun (2013). Impact of exergames on physical activity and motivation in elementary school students: A follow-up study. *J. Sport Health Sci.*, 2 (3): 138-145. doi:10.1016/j.jshs.2013.02.003
- Sun, Haichun; Gao, Yong (2016). Impact of an active educational video game on children's motivation, science knowledge, and physical activity. *J. Sport Health Sci.*, 5 (2): 239-245. doi:10.1016/j.jshs.2014.12.004
- Sun, Jerry Chih-Yuan; Kuo, Cian-Yu; Hou, Huei-Tse; Lin, Yu-Yan (2017). Exploring Learners' Sequential Behavioral Patterns, Flow Experience, and Learning Performance in an Anti-Phishing Educational Game. *Educ. Technol. Soc.*, 20 (1): 45-60.
- Sun, Koun-Tem; Lin, Ching-Ling; Wang, Sheng-Min (2010). A 3-D Virtual Reality Model of the Sun and the Moon for e-Learning at Elementary Schools. *Int. J. Sci. Math. Educ.*, 8 (4): 689-710.

- Sun, Zhong; Yang, Xian Min; He, Ke Kang (2016). An extensive reading strategy to promote online writing for elementary students in the 1: 1 digital classroom. *Comput. Assist. Lang. Learn.*, 29 (2): 398-412. doi:10.1080/09588221.2014.974860
- Sundqvist, Pia; Wikstrom, Peter (2015). Out-of-school digital gameplay and in-school L2 English vocabulary outcomes. *System*, 51: 65-76. doi:10.1016/j.system.2015.04.001
- Sylla, C.; Pereira, I. S. P.; Coutinho, C. P.; Branco, P. (2016). Digital Manipulatives as Scaffolds for Preschoolers' Language Development. *IEEE Trans. Emerg. Top. Comput.*, 4 (3): 439-449. doi:10.1109/TETC.2015.2500099
- Takaoka, Ryo; Shimokawa, Masayuki; Okamoto, Toshio (2012). A Development of Game-Based Learning Environment to Activate Interaction among Learners. *IEICE Trans. Inf. Syst.*, E95D (4): 911-920. doi:10.1587/transinf.E95.D.911
- Tanner, Patricia; Karas, Carly; Schofield, Damian (2014). Augmenting a Child's Reality: Using Educational Tablet Technology. *Journal of Information Technology Education: Innovations in Practice*, 13: 45--55.
- TAP. Exploring Play and Creativity in Pre-Schoolers' Use of Apps. www.techandplay.org
- Tay, Hui Yong (2016). Longitudinal study on impact of iPad use on teaching and learning. *Cogent Educ.*, 3: UNSP 1127308. doi:10.1080/2331186X.2015.1127308
- Telstra (2015). Balancing Screen time- cyber safety tips for parents. https://www.telstra.com.au/content/dam/tcom/personal/consumer-advice/pdf/consumer/02-06-15_CyberSafety_BalanceScreenTimeV1.pdf
- Thisgaard, Malene; Makransky, Guido (2017). Virtual Learning Simulations in High School: Effects on Cognitive and Non-cognitive Outcomes and Implications on the Development of STEM Academic and Career Choice. *Front. Psychol.*, 8: 805. doi:10.3389/fpsyg.2017.00805
- Tho, Siew Wei; Chan, Ka Wing; Yeung, Yau Yuen (2015). Technology-Enhanced Physics Programme for Community-Based Science Learning: Innovative Design and Programme Evaluation in a Theme Park. *J. Sci. Educ. Technol.*, 24 (5): 580-594. doi:10.1007/s10956-015-9549-5
- Thompson, Debbe (2017). Incorporating Behavioral Techniques into a Serious Videogame for Children. *Games Health J.*, 6 (2): 75-86. doi:10.1089/g4h.2016.0066
- Tolentino, Lisa; Birchfield, David; Megowan-Romanowicz, Colleen; Johnson-Glenberg, Mina C.; Kelliher, Aisling; Martinez, Christopher (2009). Teaching and Learning in the Mixed-Reality Science Classroom. *J. Sci. Educ. Technol.*, 18 (6): 501-517. doi:10.1007/s10956-009-9166-2
- Tomczyk, Lukasz; Wasinski, Arkadiusz (2017). Parents in the Process of Educational Impact in the Area of the Use of New Media by Children and Teenagers in the Family Environment. *Egit. Bilim*, 42 (190): 305-323. doi:10.15390/EB.2017.4674
- Tremblay et al. (2012). Canadian Sedentary Behaviour Guidelines - For the Early Years 0-4 Years. <https://www.ncbi.nlm.nih.gov/pubmed/22448609>
- Tremblay, Mark S.; LeBlanc, Allana G.; Carson, Valerie; Choquette, Louise; Gorber, Sarah Connor; Dillman, Carrie; Duggan, Mary; Gordon, Mary Jane; Hicks, Audrey; Janssen, Ian; Kho, Michelle E.; Latimer-Cheung, Amy E.; LeBlanc, Claire; Murumets, Kelly; Okely, Anthony D.; Reilly, John J.; Stearns, Jodie A.; Timmons, Brian W.; Spence, John C. (2012). Canadian Sedentary Behaviour Guidelines for the Early Years (aged 0-4 years). *Applied Physiology Nutrition and Metabolism-Physiologie Appliquee Nutrition Et Metabolisme*, 37 (2): 370-380. doi:10.1139/H2012-019
- Tremblay, Mark S.; LeBlanc, Allana G.; Carson, Valerie; Choquette, Louise; Gorber, Sarah Connor; Dillman, Carrie; Duggan, Mary; Gordon, Mary Jane; Hicks, Audrey; Janssen, Ian; Kho, Michelle E.; Latimer-Cheung, Amy E.; LeBlanc, Claire; Murumets, Kelly; Okely, Anthony D.; Reilly, John J.; Stearns, Jodie A.; Timmons, Brian W.; Spence, John C. (2012). Canadian directive with regard to sedentary behavior in young infants (0-4 years). *Applied Physiology Nutrition and Metabolism-Physiologie Appliquee Nutrition Et Metabolisme*, 37 (2): 381-391. doi:10.1139/H2012-029
- Tsai, Fu-Hsing; Tsai, Chin-Chung; Lin, Kuen-Yi (2015). The evaluation of different gaming modes and feedback types on game-based formative assessment in an online learning environment. *Comput. Educ.*, 81: 259-269. doi:10.1016/j.compedu.2014.10.013

- Tsai, Pei-Shan; Hwang, Gwo-Jen; Tsai, Chin-Chung; Hung, Chun-Ming; Huang, Iwen (2012). An Electronic Library-based Learning Environment for Supporting Web-based Problem-Solving Activities. *Educ. Technol. Soc.*, 15 (4): 252-264.
- Tsuei, Mengping; Lai, Ri-Teng (2015). Development of an Online Engineering Drawing System to Enhance Junior High School Students' Learning in an Engineering Graphics Course. *Int. J. Eng. Educ.*, 31 (2): 589-596.
- Tuezuen, Hakan; Yilmaz-Soylu, Meryem; Karakus, Tuerkan; Inal, Yavuz; Kizilkaya, Gonca (2009). The effects of computer games on primary school students' achievement and motivation in geography learning. *Comput. Educ.*, 52 (1): 68-77. doi:10.1016/j.compedu.2008.06.008
- Turkcapar, Unal (2015). Effects of Web-supported Learning on the Students' Academic Achievement and Self-esteem. *Anthropologist*, 21 (3): 535-541.
- Tuzel, Sait; Hobbs, Renee (2017). The Use of Social Media and Popular Culture to Advance Cross-Cultural Understanding. *Comunicar*, (51): 63-72. doi:10.3916/C51-2017-06
- Ucus, Sukran (2015). Elementary School Teachers' Views on Game-based Learning as a Teaching Method. *Procedia - Social and Behavioral Sciences*, 186: 401--409.
- Uhls, Yalda T.; Michikyan, Minas; Morris, Jordan; Garcia, Debra; Small, Gary W.; Zgourou, Eleni; Greenfield, Patricia M. (2014). Five days at outdoor education camp without screens improves preteen skills with nonverbal emotion cues. *Comput. Hum. Behav.*, 39: 387-392. doi:10.1016/j.chb.2014.05.036
- van der Ven, Frauke; Segers, Eliane; Takashima, Atsuko; Verhoeven, Ludo (2017). Effects of a tablet game intervention on simple addition and subtraction fluency in first graders. *Comput. Hum. Behav.*, 72: 200-207. doi:10.1016/j.chb.2017.02.031
- van Gorp, Karly; Segers, Eliane; Verhoeven, Ludo (2017). Enhancing Decoding Efficiency in Poor Readers via a Word Identification Game. *Read. Res. Q.*, 52 (1): 105-123. doi:10.1002/rrq.156
- Van Hove, Stephanie; Vanderhoven, Ellen; Cornillie, Frederik (2017). The tablet for Second Language Vocabulary Learning: Keyboard, Stylus or Multiple Choice. *Comunicar*, (50): 53-62. doi:10.3916/C50-2017-05
- Van Hove, Stephanie; Vanderhoven, Ellen; Cornillie, Frederik (2017). The tablet for Second Language Vocabulary Learning: Keyboard, Stylus or Multiple Choice. *Comunicar*, (50): 53-62. doi:10.3916/C50-2017-05
- Varier, Divya; Dumke, Erika K.; Abrams, Lisa M.; Conklin, Sarah B.; Barnes, Jamie S.; Hoover, Nancy R. (2017). Potential of one-to-one technologies in the classroom: teachers and students weigh in. *ETR&D-Educ. Tech. Res. Dev.*, 65 (4): 967-992. doi:10.1007/s11423-017-9509-2
- Vasquez, Andrea; Nussbaum, Miguel; Sciarresi, Enzo; Martinez, Tomas; Barahona, Camila; Strasser, Katherine (2017). The Impact of the Technology Used in Formative Assessment: The Case of Spelling. *J. Educ. Comput. Res.*, 54 (8): 1142-1167. doi:10.1177/0735633116650971
- Vaughan, Michelle; Beers, Courtney (2017). Using an Exploratory Professional Development Initiative to Introduce iPads in the Early Childhood Education Classroom. *Early Childhood Education Journal*, 45 (3): 321--331.
- Verhoeven, Katrien; Abeele, Vero Vanden; Gers, Brent; Seghers, Jan (2015). Energy Expenditure During Xbox Kinect Play in Early Adolescents: The Relationship with Player Mode and Game Enjoyment. *Games Health J.*, 4 (6): 444-451. doi:10.1089/g4h.2014.0106
- Vernadakis, Nikolaos; Papastergiou, Marina; Zetou, Eleni; Antoniou, Panagiotis (2015). The impact of an exergame-based intervention on children's fundamental motor skills. *Comput. Educ.*, 83: 90-102. doi:10.1016/j.compedu.2015.01.001
- Virvou, Maria; Katsionis, George (2008). In the usability and likeability of virtual reality games for education: The case of VR-ENGAGE. *Comput. Educ.*, 50 (1): 154-178. doi:10.1016/j.compedu.2006.04.004
- VSP (2017). Computer Vision Syndrome: Kids, Computers and Digital Eye Damage.
- Waite, S. J.; Wheeler, S.; Bromfield, C. (2007). Our flexible friend: The implications of individual differences for information technology teaching. *Computers & Education*, 48 (1): 80--99.

- Walker, Ros (2013). I don't think I would be where I am right now. Pupil perspectives on using mobile devices for learning." *Research in Learning Technology*, 21: 1--12.
- Wallenius, Marjut; Rimpela, Arja; Punamaki, Raija-Leena; Lintonen, Tomi (2009). Digital game playing motives among adolescents: Relations to parent-child communication, school performance, sleeping habits, and perceived health. *J. Appl. Dev. Psychol.*, 30 (4): 463-474. doi:10.1016/j.appdev.2008.12.021
- Walsh, Bridget A.; Cromer, Heidi; Weigel, Daniel J. (2014). Classroom-to-Home Connections: Young Children's Experiences With a Technology-Based Parent Involvement Tool. *Early Educ. Dev.*, 25 (8): 1142-1161. doi:10.1080/10409289.2014.904647
- Walter-Laager, Catherine; Brandenburg, Kathrin; Tinguely, Luzia; Schwarz, Jurg; Pfiffner, Manfred R.; Moschner, Barbara (2017). Media-assisted language learning for young children: Effects of a word-learning app on the vocabulary acquisition of two-year-olds. *Br. J. Educ. Technol.*, 48 (4): 1062-1072. doi:10.1111/bjet.12472
- Wang, Fuxing; Xie, Heping; Wang, Yuxin; Hao, Yanbin; An, Jing (2016). Using Touchscreen Tablets to Help Young Children Learn to Tell Time. *Front. Psychol.*, 7: 1800. doi:10.3389/fpsyg.2016.01800
- Wang, Jing Jing; Baranowski, Tom; Lau, Patrick W. C.; Buday, Richard; Gao, Yang (2017). Story Immersion May Be Effective in Promoting Diet and Physical Activity in Chinese Children. *J. Nutr. Educ. Behav.*, 49 (4): 321-329. doi:10.1016/j.jneb.2017.01.001
- Wang, Jingying; Guo, Donghui; Jou, Min (2015). A study on the effects of model-based inquiry pedagogy on students' inquiry skills in a virtual physics lab. *Comput. Hum. Behav.*, 49: 658-669. doi:10.1016/j.chb.2015.01.043
- Wang, June-Yi; Wu, Hsin-Kai; Chien, Sung-Pei; Hwang, Fu-Kwun; Hsu, Ying-Shao (2015). Designing Applications for Physics Learning: Facilitating High School Students' Conceptual Understanding by Using Tablet PCs. *J. Educ. Comput. Res.*, 51 (4): 441-458. doi:10.2190/EC.51.4.d
- Wang, June-Yi; Wu, Hsin-Kai; Hsu, Ying-Shao (2017). Using mobile applications for learning: Effects of simulation design, visual-motor integration, and spatial ability on high school students' conceptual understanding. *Comput. Hum. Behav.*, 66: 103-113. doi:10.1016/j.chb.2016.09.032
- Wang, Pei-Yu; Yang, Hui-Chun (2016). The impact of e-book interactivity design on children's Chinese character acquisition. *Interact. Learn. Environ.*, 24 (4): 784-798. doi:10.1080/10494820.2014.917112
- Wang, Shiang-Kwei; Reeves, Thomas C. (2007). The effects of a web-based learning environment on student motivation in a high school earth science course. *ETR&D-Educ. Tech. Res. Dev.*, 55 (2): 169-192. doi:10.1007/s11423-006-9016-3
- Wang, T. H. (2014). Implementation of Web-based argumentation in facilitating elementary school students to learn environmental issues. *J. Comput. Assist. Learn.*, 30 (5): 479-496. doi:10.1111/jcal.12061
- Wang, Y. -H. (2016). Could a mobile-assisted learning system support flipped classrooms for classical Chinese learning? *J. Comput. Assist. Learn.*, 32 (5): 391-415. doi:10.1111/jcal.12141
- Wang, Yi-Hsuan (2017). Exploring the effectiveness of integrating augmented reality-based materials to support writing activities. *Comput. Educ.*, 113: 162-176. doi:10.1016/j.compedu.2017.04.013
- Watts, Christina M.; Moyer-Packenham, Patricia S.; Tucker, Stephen I.; Bullock, Emma P.; Shumway, Jessica F.; Westenskow, Arla; Boyer-Thurgood, Jennifer; Anderson-Pence, Katie; Mahamane, Salif; Jordan, Kerry (2016). An examination of children's learning progression shifts while using touch screen virtual manipulative mathematics apps. *Comput. Hum. Behav.*, 64: 814-828. doi:10.1016/j.chb.2016.07.029
- Watts, Christina M.; Moyer-Packenham, Patricia S.; Tucker, Stephen I.; Bullock, Emma P.; Shumway, Jessica F.; Westenskow, Arla; Boyer-Thurgood, Jennifer; Anderson-Pence, Katie; Mahamane, Salif; Jordan, Kerry (2016). An examination of children's learning progression shifts while using touch screen virtual manipulative mathematics apps. *Comput. Hum. Behav.*, 64: 814-828. doi:10.1016/j.chb.2016.07.029

- Webber, Ann L.; Wood, Joanne M.; Thompson, Benjamin (2016). Fine Motor Skills of Children With Amblyopia Improve Following Binocular Treatment. *Invest. Ophthalmol. Vis. Sci.*, 57 (11): 4713-4720. doi:10.1167/iovs.16-19797
- Wei, Whei-Jane; Lee, Lai-Chung (2015). Interactive Technology for Creativity in Early Childhood Education. *J. Teknol.*, 75 (3): 121-126.
- Wennersten, Matthew; Quraishy, Zubeeda Banu; Velamuri, Malathi (2015). Improving student learning via mobile phone video content: Evidence from the BridgelT India project. *International Review of Education*, 61 (4): 503--528.
- White, D. Heather; Robertson, Lorayne (2015). Implementing assistive technologies: A study on co-learning in the Canadian elementary school context. *Comput. Hum. Behav.*, 51: 1268-1275. doi:10.1016/j.chb.2014.12.003
- Willoughby, David; Evans, Mary Ann; Nowak, Sarah (2015). Do ABC eBooks boost engagement and learning in preschoolers? An experimental study comparing eBooks with paper ABC and storybook controls. *Computers & Education*, 82: 107--117.
- Wilson, Sarah (2016). Digital technologies, children and young people's relationships and self-care. *Child. Geogr.*, 14 (3): 282-294. doi:10.1080/14733285.2015.1040726
- Wojciechowski, Adam; Al-Musawi, Raed (2017). Assisstive technology application for enhancing social and language skills of young children with autism. *Multimedia Tools and Applications*, 76 (4): 5419--5439.
- Wojciechowski, Rafal; Cellary, Wojciech (2013). Evaluation of learners' attitude toward learning in ARIES augmented reality environments. *Comput. Educ.*, 68: 570-585. doi:10.1016/j.compedu.2013.02.014
- Wolgemuth, Jennifer R.; Savage, Robert; Helmer, Janet; Harper, Helen; Lea, Tess; Abrami, Phillip C.; Kirby, Adrienne; Chalkiti, Kalotina; Morris, Peter; Carapetis, Jonathan; Loudon, William (2013). ABRACADABRA aids Indigenous and non-Indigenous early literacy in Australia: Evidence from a multisite randomized controlled trial. *Comput. Educ.*, 67: 250-264. doi:10.1016/j.compedu.2013.04.002
- Wong, Suzanna So-Har (2015). Mobile Digital Devices and Preschoolers' Home Multiliteracy Practices. *Lang. Liter.*, 17 (2): 75-90.
- Wongwatkit, Charoenchai; Srisawasdi, Niwat; Hwang, Gwo-Jen; Panjaburee, Patcharin (2017). Influence of an integrated learning diagnosis and formative assessment-based personalized web learning approach on students learning performances and perceptions. *Interact. Learn. Environ.*, 25 (7): 889-903. doi:10.1080/10494820.2016.1224255
- Woods, Heather Cleland; Scott, Holly (2016). #Sleepyteens: Social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem. *J. Adolesc.*, 51: 41-49. doi:10.1016/j.adolescence.2016.05.008
- Woolford, Susan J.; Clark, Sarah J.; Strecher, Victor J.; Resnicow, Kenneth (2010). Tailored mobile phone text messages as an adjunct to obesity treatment for adolescents. *JOURNAL OF TELEMEDICINE AND TELE CARE*, 16 (8): 458--461.
- Wray, David (2015). An Exploration of the Views of Teachers Concerning the Effects of Texting on Children's Literacy Development. *Journal of Information Technolgy Education-Research*, 14: 271-282.
- Wrzesien, Maja; Raya, Mariano Alcaniz (2010). Learning in serious virtual worlds: Evaluation of learning effectiveness and appeal to students in the E-Junior project. *Comput. Educ.*, 55 (1): 178-187. doi:10.1016/j.compedu.2010.01.003
- Wrzesien, Maja; Rodriguez, Alejandro; Rey, Beatriz; Alcaniz, Mariano; Maria Banos, Rosa; Dolores Vara, Ma (2015). How the physical similarity of avatars can influence the learning of emotion regulation strategies in teenagers. *Comput. Hum. Behav.*, 43: 101-111. doi:10.1016/j.chb.2014.09.024

- Wu, Chia-Jung; Chen, Gwo-Dong; Huang, Chi-Wen (2014). Using digital board games for genuine communication in EFL classrooms. *ETR&D-Educ. Tech. Res. Dev.*, 62 (2): 209-226. doi:10.1007/s11423-013-9329-y
- Wu, Cynthia Sau Ting; Fowler, Cathrine; Lam, Winsome Yuk Yin; Wong, Ho Ting; Wong, Charmaine Hei Man; Loke, Alice Yuen (2014). Parenting approaches and digital technology use of preschool age children in a Chinese community. *Ital. J. Pediatr.*, 40: 44. doi:10.1186/1824-7288-40-44
- Wu, Kochiu; Chen, Hung-Chun (2016). Children use second-and third-dimensional digital library interfaces. *Libr. Hi Tech*, 34 (1): 21-35. doi:10.1108/LHT-07-2015-0078
- Wu, Po-Han; Hwang, Gwo-Jen; Tsai, Wen-Hung (2013). An Expert System-based Context-Aware Ubiquitous Learning Approach for Conducting Science Learning Activities. *Educ. Technol. Soc.*, 16 (4): 217-230.
- Xie, Xiaochun; Zhao, Fengqing; Xie, Julan; Lei, Li (2016). Symbolization of mobile phone and life satisfaction among adolescents in rural areas of China: Mediating of school-related relationships. *Computers in Human Behavior*, 64: 694--702.
- Xin, Joy F.; Sheppard, Mary E.; Brown, Michelle (2017). Brief Report: Using iPads for Self-Monitoring of Students with Autism. *Journal of Autism and Developmental Disorders*, 47 (5): 1559--1567.
- Xu, Zhenhua; Jang, Eunice Eunhee (2017). The role of math self-efficacy in the structural model of extracurricular technology-related activities and junior elementary school students' mathematics ability. *Comput. Hum. Behav.*, 68: 547-555. doi:10.1016/j.chb.2016.11.063
- Yang, Che-Ching; Hwang, Gwo-Jen; Hung, Chun-Ming; Tseng, Shian-Shyong (2013). An Evaluation of the Learning Effectiveness of Concept Map-Based Science Book Reading via Mobile Devices. *Educational Technology & Society*, 16 (3): 167--178.
- Yang, Euphony F. Y.; Chang, Ben; Cheng, Hercy N. H.; Chan, Tak-Wai (2016). Improving Pupils' Mathematical Communication Abilities through Computer-Supported Reciprocal Peer Tutoring. *Journal of Educational Technology & Society*, 19 (3): 157--169.
- Yang, Hsuan-Che; Chang, Wen-Chih (2017). Ubiquitous smartphone platform for K-7 students learning geography in Taiwan. *Multimed. Tools Appl.*, 76 (9): 11651-11668. doi:10.1007/s11042-016-3325-2
- Yang, Junfeng; Yu, Huiju; Gong, Chaohua; Chen, Nian-Shing (2017). Students' Perceptions and Behaviour in Technology-Rich Classroom and Multi-Media Classroom. *Eurasia J. Math. Sci. Technol. Educ.*, 13 (3): 621-647. doi:10.12973/eurasia.2017.00636a
- Yang, Ya-Ting C.; Wu, Wan-Chi I. (2012). Digital storytelling for enhancing student academic achievement, critical thinking, and learning motivation: A year-long experimental study. *Comput. Educ.*, 59 (2): 339-352. doi:10.1016/j.compedu.2011.12.012
- Yannier, Nesra; Hudson, Scott E.; Wiese, Eliane Stampfer; Koedinger, Kenneth R. (2016). Adding Physical Objects to an Interactive Game Improves Learning and Enjoyment: Evidence from EarthShake. *ACM Trans. Comput.-Hum. Interact.*, 23 (4): 26. doi:10.1145/2934668
- Yapici, I. Umit; Akbayin, Hasan (2012). The Effect of Blended Learning Model on High School Students' Biology Achievement and on their Attitudes Towards the Internet. *Turk. Online J. Educ. Technol.*, 11 (2): 228-237.
- Yarkova, T. A.; Cherkasova, I. I.; Timofeeva, A. M.; Cherkasov, V. V.; Yarkov, V. G. (2017). Preparing Teachers to Use New Media Visual Communications in Education. *International Journal of Emerging Technologies in Learning*, 12 (2): 4--15.
- Yien, Jui-Mei; Hung, Chun-Ming; Hwang, Gwo-Jen; Lin, Yueh-Chiao (2011). A Game-based Learning Approach to Improving Students' Learning Achievements in a Nutrition Course. *Turk. Online J. Educ. Technol.*, 10 (2): 1-10.
- Yi-Frazier, Joyce P.; Cochrane, Katherine; Mitrovich, Connor; Pascual, Michael; Buscaino, Emil; Eaton, Lauren; Panlasigui, Neil; Clopp, Bailey; Malik, Faisal (2015). Using Instagram as a Modified Application of Photovoice for Storytelling and Sharing in Adolescents With Type 1 Diabetes. *QUALITATIVE HEALTH RESEARCH*, 25 (10): 1372--1382.

- Yilmaz, Rabia M.; Kucuk, Sevda; Goktas, Yuksel (2017). Are augmented reality picture books magic or real for preschool children aged five to six? *Br. J. Educ. Technol.*, 48 (3): 824-841. doi:10.1111/bjet.12452
- Yilmaz, Rabia Meryem; Goktas, Yuksel (2017). Using augmented reality technology in storytelling activities: examining elementary students' narrative skill and creativity. *Virtual Real.*, 21 (2): 75-89. doi:10.1007/s10055-016-0300-1
- Yong, Su Ting; Gates, Peter; Harrison, Ian (2016). Digital Games and Learning Mathematics: Student, Teacher and Parent Perspectives. *Int. J. Serious Games*, 3 (4): 55-68. doi:10.17083/ijsg.v3i4.112
- Yoon, Susan A.; Elinich, Karen; Wang, Joyce; Steinmeier, Christopher; Tucker, Sean (2012). Using augmented reality and knowledge-building scaffolds to improve learning in a science museum. *Int. J. Comp.-Support. Collab. Learn.*, 7 (4): 519-541. doi:10.1007/s11412-012-9156-x
- Yuill, Nicola; Martin, Alex F. (2016). Curling Up With a Good E-Book: Mother-Child Shared Story Reading on Screen or Paper Affects Embodied Interaction and Warmth. *Front. Psychol.*, 7: 1951. doi:10.3389/fpsyg.2016.01951
- Zack, Elizabeth; Barr, Rachel (2016). The Role of Interactional Quality in Learning from Touch Screens during Infancy: Context Matters. *Front. Psychol.*, 7: 1264. doi:10.3389/fpsyg.2016.01264
- Zack, Elizabeth; Barr, Rachel; Gerhardstein, Peter; Dickerson, Kelly; Meltzoff, Andrew N. (2009). Infant imitation from television using novel touch screen technology. *Br. J. Dev. Psychol.*, 27: 13-26. doi:10.1348/026151008X334700
- Zaharias, Panagiotis; Michael, Despina; Chrysanthou, Yiorgos (2013). Learning through Multi-touch Interfaces in Museum Exhibits: An Empirical Investigation. *Educ. Technol. Soc.*, 16 (3): 374-384.
- Zander, Steffi; Wetzels, Stefanie; Bertel, Sven (2016). Rotate it! - Effects of touch-based gestures on elementary school students' solving of mental rotation tasks. *Comput. Educ.*, 103: 158-169. doi:10.1016/j.compedu.2016.10.007
- Zanuncio, Sharinna Venturim; Tavares Mafra, Simone Caldas; Rebelo, Francisco; Filgueiras, Ernesto (2012). The use software ERGOSHOW in the education of health and safety at work to regardin the safety to children. *Work: A Journal of Prevention Assessment & Rehabilitation*, 41 (1): 915--921.
- Zevenbergen, Robyn; Logan, Helen (2008). Computer use by preschool children - Rethinking practice as digital natives come to preschool. *Aust. J. Early Child.*, 33 (1): 37-44.
- Zhang G, Wu L, Zhou L, Lu W, Mao C. (2016). Television watching and risk of childhood obesity: a meta-analysis. *Eur J Public Health*. 26(1):13-8. doi: 10.1093/eurpub/ckv213. Epub 2015 Nov 24.
- Zhang, Hui; Zhu, Chang (2016). A Study of Digital Media Literacy of the 5th and 6th Grade Primary Students in Beijing. *Asia-Pac. Educ. Res.*, 25 (4): 579-592. doi:10.1007/s40299-016-0285-2
- Zhang, Yiyun; Zhou, Xinlin (2016). Building Knowledge Structures by Testing Helps Children With Mathematical Learning Difficulty. *J. Learn. Disabil.*, 49 (2): 166-175. doi:10.1177/0022219414538515
- Zimmerman, Heather Toomey; Land, Susan M.; Jung, Yong Ju (2016). Using Augmented Reality to Support Children's Situational Interest and Science Learning During Context-Sensitive Informal Mobile Learning. 406: 101--119.
- Zimmermann, Laura; Moser, Alecia; Grenell, Amanda; Dickerson, Kelly; Yao, Qianwen; Gerhardstein, Peter; Barr, Rachel (2015). Do semantic contextual cues facilitate transfer learning from video in toddlers? *Front. Psychol.*, 6: 561. doi:10.3389/fpsyg.2015.00561
- Zucker, Andrew A.; Hug, Sarah T. (2008). Teaching and Learning Physics in a 1:1 Laptop School. *J. Sci. Educ. Technol.*, 17 (6): 586-594. doi:10.1007/s10956-008-9125-3
- Zuiker, Steven J. (2012). Educational virtual environments as a lens for understanding both precise repeatability and specific variation in learning ecologies. *Br. J. Educ. Technol.*, 43 (6): 981-992. doi:10.1111/j.1467-8535.2011.01266.x
- Zurita, Gustavo; Nussbaum, Miguel (2007). A conceptual framework based on Activity Theory for mobile CSCL. *British Journal of Educational Technology*, 38 (2): 211--235.

Appendix A: Semi-structured interview guide

The following questions were used in semi-structured interviews to establish the positions of key stakeholders and senior researchers on the use of digital technologies in education contexts:

- 1) What is your position on the use of digital technology in the educational context?
- 4) What informed your process to reach this position?
- 5) Do you follow or have you implemented any formal guidelines in relation to educational technology use?
- 6) Is there anyone else you can suggest we should approach?