

The impact of digital media on health: children's perspectives

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Abstract

Objectives Previous research has mainly focused on the effects of excessive digital media use or overuse on the health of children, primarily utilizing quantitative designs. More research should be conducted on general populations of children, rather than focusing exclusively on excessive technology users. This qualitative study describes technology's impact on physical and mental health from children's perspectives.

Methods Focus groups and interviews were conducted with children between the ages of 9 and 16 in 9 European countries ($N = 368$). During focus groups and interviews, researchers asked what children perceive as being potentially negative or problematic while using the internet and technology.

Results In this study, children reported several physical and mental health problems without indicating internet addiction or overuse. Physical health symptoms included eye problems, headaches, not eating, and tiredness. For mental health symptoms, children reported cognitive salience of online events, aggression, and sleeping problems. Sometimes they reported these problems within 30 min of technology usage. This suggests that even

shorter time usage can cause self-reported health problems for some children.

Conclusions Qualitative methodology helps to understand what children's perspectives are concerning the impact of digital media on health. We recommend future studies focused on average technology users and low technology users to determine whether average levels of technology usage relate to health problems of children. Parents and teachers should also be informed about the possible physical and mental health issues associated with children's average usage of technology.

Keywords Digital media · Physical health · Mental health · Technology

Introduction

Nowadays technology is deeply embedded in children's lives. Their experiences with these technologies range from the negative to the positive, with the bulk of research focused on risky online behaviors (e.g., Kuss et al. 2013; Weaver et al. 2011). Less attention has been given to children's experiences of the health-related outcomes of prolonged technology usage, including headaches, stomachaches, eye problems, excessive daytime sleepiness, and poor eating habits (Do et al. 2013; Mazer and Ledbetter 2012; Nuutinen et al. 2014). Most of the research on these topics is quantitative, and is concerned with excessive internet usage and internet addiction as they relate to health. In this study, we investigate children who are using technology at least weekly and focus on children's perceptions of the health consequences associated with their utilization of new media. To fully understand these differences, we employ a child-centered approach, which has not been used in previous research.

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Health-related outcomes of technology

As an enduring interest in the literature, much attention has been given to the relationship of physical health and psychological well-being to children's usage of technology. Most of the current research studying the impact of technology on health is, unfortunately, focused on comparing "average users" to "excessive," "intense," or "heavy" users as we can see next in the theoretical section. But technology has some impact on all children, including low and average users.

Using a large sample of adolescents, Austin and Totaro (2011) found that intense internet usage, defined as utilizing the internet in various locations (e.g., at home, plus friend's house, a café, through mobile phone), was related positively to skipping school among male students but not female students. In addition, intense internet usage was associated positively with not attending school due to feeling sick among female students. Within this study, the definition of "intense internet usage" is based on the amount of locations where the internet is used, but in some countries this definition might be overly applied to their users. Delineating between compulsive internet usage and excessive internet usage, Mazer's and Ledbetter's (2012) study revealed that compulsive internet usage predicted physical symptoms, like headaches, stomachaches, and eye problems.

Although the burgeoning research on the topic of technology usage and health-related consequences of technology usage has focused some attention on how such usage relates to obesity or overweightness, little attention has been given to eating problems as they relate to prolonged technology usage. Among this research, Kim and colleagues (2010) found that Hong Kong university students, who were heavy internet users, were twice as likely to be overweight and engage in unhealthy behaviors, like skipping meals, and living a sedentary lifestyle. Similarly, Do and colleague's (2013) study revealed linkages between heavy internet usage and obesity among Korean adolescents (13–17-year olds). Expanding this research, Kim's and Chun's (2005) results revealed that severe internet addiction related to poorer diet and less regular exercise among Korean adolescents. Other research (i.e. Tao and Liu 2009) has focused on Chinese adolescents' and adults' internet dependency in relation to eating attitudes, and the symptoms and psychological characteristics of eating disorders. Internet-dependent individuals engaged in more dieting behaviors, had more bulimic symptoms, and oral control issues compared to non-internet-dependent individuals.

Just as a variety of researchers have linked technology usage to physical problems, there is ample research linking problematic internet usage and internet addiction to mental health issues, including emotional instability, depression,

loneliness, anxiety, and impulsivity (Augner and Hacker 2012; Cheung and Wong 2011; Ha et al. 2006; Lee et al. 2008; Shaw and Black 2008). In addition, Korean adolescents who utilized the internet greater than the average user self-reported more suicidal ideation (Do et al. 2013). Similarly, compulsive internet users and internet game addicts reported higher rates of hopelessness, nervousness, and worthlessness (Mazer and Ledbetter 2012). Cao et al. (2007) and Ha et al. (2006) also found that internet addiction was associated positively with psychiatric disorders. Insomnia, a type of psychiatric disorder, was also reported by heavy internet users (Jenaro et al. 2007). Expanding to different technologies, Punamäki and colleague's (2007) study revealed that intensive mobile technology users experienced waking-time tiredness and other unhealthy sleeping habits, like sleeping late. Internet and computer game addicts also reported sleep quality issues, nightmares, and dreams with aggressive content (du Toit et al. 2004; Gackenbach and Kuruvilla 2008; Van den Bulck 2004). Focusing on non-addicts, Choi et al. (2009) found that Korean adolescents with greater internet usage experienced excessive daytime sleepiness. In addition, Nuutinen and colleagues (2014) found that heavy computer usage was associated with shorter sleep duration among Finnish, French, and Danish 15-year olds.

There are also health-related social consequences of technology usage. In particular, high internet usage is associated positively with poorer interpersonal skills, poorer family interactions, poorer quality of life, and a greater tolerance for violence (Ko et al. 2009; Weaver et al. 2011; Wei 2007). In addition, research by Peter and Valkenburg (2011) revealed that exposure to pornography with unsafe sexual activity increased the risk of males engaging in sexual activity without condoms. Other research indicates that frequent internet usage is associated with the perpetration of cyberbullying (Arıcak et al. 2008).

Though there are a variety of negative impacts associated with technology usage, there are a variety of studies that report positive impacts of such usage. These studies reveal that technology usage relates to feeling increased social support, social affinity, positive emotions, and positive attitudes toward school (Lee et al. 2008; Koo et al. 2011; Mitzner et al. 2010; Smahel 2003). This means that the impacts of technology can be both positive and negative.

Research goal

In this investigation, we focused on children's perceptions of the negative health-related consequences linked to their technology usage. The health-related consequences were spontaneously reported within the context of other problematic aspects of technology use.

Methods

Sample and data collection

This research was organized within the network of the EU Kids Online III project. The following nine European countries were included in data collection: Belgium, the Czech Republic, Greece, Malta, Italy, Portugal, Romania, Spain, and the United Kingdom. The main fieldwork was carried out from February to September 2013. The average number of focus groups was six in each country; three focus groups with girls and three with boys, with age distributions of 9–10 years, 11–13 years, and 14–16 years (two focus groups each). The average number of interviews was twelve in each country, with the same gender and age distributions. Children were selected from at least three different schools (public \times private, city \times suburban \times rural schools) and/or youth centers. At one school or youth center, typically two focus groups and four interviews with different children were carried out. This research included 56 focus groups ($N = 254$) and 114 interviews ($N = 114$) conducted across the nine countries. Details about sampling and methodology are presented in an extensive research report (Smahel and Wright 2014).

The study received ethics approval from the LSE Research Ethics Committee (UK). Researchers also fulfilled their countries' national ethics requirements. Participants were informed about the research in an understandable way and they provided their written informed consent.

A common topic guide with lists of questions was used across the countries. During focus groups and interviews, researchers asked what children perceive as being potentially negative or problematic while using the internet, the risks and consequences of their usage, how they react to and avoid negative experiences, and how they evaluate situations that adults consider problematic. In this study, we describe European children's perceptions of technology's impact on health. Due to being outside the scope of this article, we did not examine cross-country differences.

Coding and analytical procedure

Focus groups and interviews were transcribed in the national language of each country (9 languages). The first level of coding was focused on condensed descriptions of the material in the English language (Rennie et al. 1988). First level codes were self-explanatory descriptions concerning the whole material. Codes included the context of the situation and distinguished who experienced the situation (e.g., the child, someone the child knew, from the media). The total number of first level codes was 26,696. From all focus groups and interviews, researchers

translated the relevant paragraphs to determine the 5–10 most interesting passages. The translated parts (total of 1,432) were highlighted and stored in a separate file. Two researchers independently coded at least two of the same transcripts, merged their coding into one file, discussed differences in their coding, and sent results for verification to the coordinator. The coordinator reviewed the documents according to the coding manual to ensure the quality of the coding procedure across the countries.

Because the material collected in the first level of coding was extremely large, thematic analyses procedures were applied (Fereday and Muir-Cochrane 2006). The following areas were covered in the second level of coding—research area: problematic situation experience, problematic situation impact, problematic situation awareness, preventative measures, online activities, mediation, literacy, opportunities, researchers' comments, off-topic, and the type of problematic situations, which included situations involving strangers, bullying and harassment, sex, unwanted content, commercial risks, technical problems, health and overuse. Five research assistants from the Czech team coded first level codes for all countries. The reliability of coding across the coders was ensured, with a Kappa of 0.70 for each category.

For the purpose of this article, we analyzed “health,” a type of problematic situation, which covers children's statements related to the health issues associated with new media usage. Altogether, 600 level codes and sections of interviews close to these codes were analyzed for this article. Researchers used NVivo software to sort and print materials.

Results

Children's experiences about health-related problems associated with technology usage were divided into two categories: physical health experiences and mental health experiences (see Table 1). The physical health category describes the physical impacts of internet experiences as reported by children. This category reflects children's perceptions of these experiences. The mental health category is connected to psychological problems and issues related to technology usage. This category summarizes children's perceptions of their experiences with psychological problems.

Physical health experiences

Children reported experiencing a variety of eye problems, such as their eyes hurting, eyestrain, and needing to wear glasses due to prolonged internet usage. A nine-year-old boy (focus group [FG], Portugal) said, “I've been online

Table 1 Children's perceptions of the physical and mental health impacts of technology usage from nine European countries in 2013

Physical health	Mental health
Eye problems	Cognitive salience
Wearing glasses because of the computer	Sexual and gory images remained in his/her head after playing online games
Eyes hurting	Cognitive salience with images from games
Eye strain	
Headaches	Aggression
Head hurts because of games or Facebook	Hitting things
Headaches because he/she spent too much time online	Try to break the computer because of technical problems in games
	Aggressive behavior caused by the lack of digital literacy
	Aggression against people who are disturbing them from using technology
Not eating	Sleeping problems
Forgot to eat because of playing online games	Nightmares
	Cannot sleep because of violent games and bad movies
	Not able to sleep alone
Tiredness	
Getting tired because of sitting in front of the computer screen	

for four and a half hours, and my eyes started to hurt". A Romanian girl remarked (FG, 13 years old), "I still wear glasses because of the computer". The reasons expressed by most of the children for eye problems were connected to the computer screen or due to overuse of the computer. Children reported health problems when they, in their perception, stayed "online too much" using Facebook or playing online games. Children reported headaches as explained by a 16-year-old boy (interview [INT], Portugal), "I don't like to be there (on Facebook) for too long, because it makes my head hurt". These problems also reflect a story of boy who explained that he cannot stay online too long because his headache leads him to stop playing online games:

"Researcher: do you sometimes play online for a long time?"

Boy: no, because I get headaches and then I stop" (INT, 13 years old, boy, Portugal).

Some children also reported feeling tired after playing online games longer than 30 min as reported by a boy from Portugal: "When I play online, I play at most for half an hour because if I play more I get tired" (FG, 11–13 years old, boys, Portugal). Children reported health problems usually in connection to gaming or using social networking sites. But in some cases, tiredness was also linked to children's schoolwork. For example: "I was doing schoolwork for my teacher on the computer and I felt my eyes getting tired and I was then feeling tired" (FG, 11 years old, boys, Greece).

Various physical health problems, such as eye problems and headaches, are sometimes reported together: "After too much time, after a while, usually after one hour and a half, I turn it off (PC) because I felt that my eyes were uncomfortable, or I have a headache. I stop and do something else" (INT, 11–13 years old, boy, Italy).

Physical health experiences after using technology are sometimes linked to children's poor eating habits, especially because of playing online games. A girl (FG, 14–16, Portugal) said, "I've gone 24 h without eating".

Mental health experiences

Children experienced aggression against objects, like parts of computers (e.g., keyboards, computer screen). They also reported hitting something or acting aggressively because of technical issues with games, slow internet, or being disconnected from the internet. A 14-year-old boy explained [interview (INT), Czech]:

"When the internet shuts down during the game, that is worse. So I broke the keyboard. I also just hit the wall next to me".

Cases of aggressive reactions connected to the lack of digital literacy were also reported. Children typically reported situations in which they might not know how to close pop-ups or block advertisements.

Children also mentioned aggressive behavior involving swearing. One boy reported (Czech, FG, 12–14): "I wrote that he was a jerk. So I found out who it was. So I came to him. I began to bitch at him". Such cases are usually linked with others' behaviors which participants perceived as

inappropriate, such as when someone swore at them, stole their online account, or bothered their friends. They also described aggression against people caused by intensive usage of devices. To illustrate, a 9-year-old boy (INT, Greece) explained:

“Sometimes I sit in front of the PC and don’t even listen to what others say! Once my brother was talking to me and was distracting me, but I didn’t want to drop what I was doing, so I pushed him away and threw him on a chair!”

Cognitive salience describes vivid memory images which could stay in one’s mind after online experiences (Gackenbach and Kuruvilla 2008). Experiences connected to these eidetic images include seeing sexual images, playing violent games, and viewing scary content. Children described situations involving images that were “stuck” or “remained” in their head. One boy reported, “Sometimes you’re on YouTube and there are videos that make you sick. Sometimes I quit but they remain in my head” (FG, 9–10, Spain). Another boy described a similar experience: “Some videos I see on the internet make me scared. And frightening things stay in my mind” (INT, 9–10, Spain). Cognitive salience and vivid images were also connected to sleep problems. Children had vivid experiences that caused sleep problems, such as nightmares. They also reported problems with sleeping or situations when they were too scared to sleep alone. These experiences were mostly connected to gory content or playing violent games. The bulk of these cases involving sleeping problems and cognitive silence were reported by 9–10-year olds. A 10-year-old boy reported the following experience (INT, Czech):

“And those bad dreams, I think that is the worst, because I cannot sleep. I’m tired and then I am mad because I cannot sleep, because I’m afraid that I will have those bad dreams. Therefore, I do not want to sleep, I’m afraid and then I am so tired”.

Interestingly, children never reported physical and mental health problems together.

Discussion

In this section, we discuss our findings concerning the impact of technology on children’s physical and mental health.

Physical health

In the context of technology usage, children in our research reported experiences of health problems mainly connected to eye problems, headaches, eating problems, and tiredness. Previous research has revealed that such health

problems relate to online addiction or prolonged technology usage, typically concluding that internet overuse is associated with health problems (Do et al. 2013; Kim et al. 2010; Mazer and Ledbetter 2012). However, in our study, children often reported health problems without indicating internet addiction or overuse, and sometimes they reported these problems after 30 min of technology usage. This suggests that even shorter time usage can cause self-reported health problems for some children. Therefore, we recommend future studies focused on average technology users in comparison to low technology users to determine whether average levels of technology usage relate to health problems. Future longitudinally designed research should focus on the long-term effects of technology usage.

Children in our research mentioned headaches and tiredness, typically after gaming or using social networking sites, but in some cases they also mentioned feeling tired while completing schoolwork, which required the usage of computers. However, we do not know if cognitively demanding online activities, i.e. gaming in some cases, have different health impacts as less demanding activities, i.e. reading blogs or watching videos. This is an especially important consideration in the context of schoolwork as one of the online activities. Further research should focus on the recommended amount of time children should spend on different online activities.

Mental health

When describing mental health problems in the context of digital media, children often mentioned cognitive salience experiences, such as sexual or gory images remaining in their head, aggressive behaviors, and sleeping problems, such as nightmares after playing violent games or watching bad movies. Cognitive salience and sleeping problems were reported even after seeing sexual, gory, or violent content once. In previous research, cognitive salience was described in the context of excessive technology usage and was proposed as one factor involved in developing addiction (Griffiths 2000) and a greater tolerance for violence (Wei 2007). In our investigation, children rarely reported mental health consequences in the context of online addiction. Thus, future research should investigate how these problems impact non-addicted children.

Gackenbach and Kuruvilla (2008) found that college students experience nightmares and bad dreams after online gaming. Related to these findings, our investigation suggests that various online content, not just gaming, influence sleep and dreams among younger children, particularly those between the ages of 9–11 years old. Further quantitative research is needed to verify under which conditions younger children are at risk for nightmares and bad dreams.

Children in our research also reported various kinds of aggressive behavior as an impact of their technology usage (see Table 1 for overview). But we cannot conclude that technology usage has an impact on children's aggressive behavior. Children experience various situations offline or online, and both have an impact on their aggressive behavior. Technology is just one tool and environment which influences children.

In our research, children did not mention physical and mental health problems together as impacts of their online experiences. It might be that both problems are interconnected in some cases, i.e. children can have physical problems after nightmares. Future research should investigate whether physical and mental health problems are interconnected.

Limitations and practical implications

This research presents children's perspectives, which has several limitations. Children mostly described direct effects of technology usage on their health. They were unable to reflect more on indirect influences. This effect might be caused by the self-positivity bias, which explains that children can be unrealistically optimistic about their own health risk perceptions (Menon et al. 2008). The self-positivity bias might explain why children report problems which are clearly connected to their technology usage but they may ignore some other less evident impacts on health, such as obesity (Kim et al. 2010). Obesity was not mentioned by children in our investigation.

Another limitation is that the focus of this research was on children's online problematic situations more generally and health problems were reported spontaneously. If researchers focused only on health issues, children might report more experiences. This study's results are more authentic and embedded in children's other online experiences. Description of these technology usage contexts is missing in this article because of limited space.

We recommend that parents be informed about the possible impacts of technology usage on children's physical and mental health. Parents should be aware that some children can have physical problems even after a short time of using technology. In addition, mental health problems, such as nightmares or sleep problems, occurred after watching an inappropriate video or playing a violent game only once.

Recommendations to teachers are connected to children's usage of computers for schoolwork when it is counterproductive. We believe that children should not be overloaded by online schoolwork, especially at younger ages. Further research should be conducted to bring more insight to this concern.

Our recommendation for public health policy makers concerns children's experience of nightmares after watching gory or violent videos on the internet. Therefore, it would be appropriate to promote the necessity of registering children's ages for the viewing of audio-visual content, which would then select videos with regard to the age of the user.

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