

The Effect of Handheld Technology Use on the Health and Education of Young Children

Raghad Alfaez

2142050

alfa0085@flinders.edu.au

Supervisor: Dr Brett Wilkinson

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DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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ABSTRACT

Technologies are utilised to make human life more convenient and have increasingly become an integral part of daily family members' activities for a variety of purposes ranging from entertainment, education, and communication. However, there is the potential for people to find it difficult to remove themselves from technology. Advantages and disadvantages of technologies given to children notably received strong attention and became more puzzling due to inconsistent outcomes presented in the literature. To investigate these issues, the project presented in this thesis utilised a survey which targeted families with young children. The survey was designed with questions mapped into categories: general, focus, society and parent in a way to examine the study's main hypotheses. Three research investigations were proposed concerning (1) parent control over children technology use (2) academic attainment with technology (3) health-related issues of technology consumptions on children. The surveys were completed by 71 participant families comprising 111 children. It was found that the majority of parents impose restrictions on their children's technology use; their restrictions were based on limiting time spent, restricting content or both. To investigate the academic development and potential health impact statistical tests were conducted on the survey data attempting to examine the following issues: (1) *What is the effect of the time spent on handheld devices to a child's academic level?* (2) *Does the use of handheld devices have a negative or positive impact on children's health?* The responses to the survey questions were evaluated using both Chi-square and t-test to identify any significant findings supporting or refuting the above issues. It was discovered that (1) the greater a parent's awareness of technology and restriction of content on handheld devices results in higher academic attainment. (2) Based on the questions asked, the perception and reporting of parents on the health of their children directly related to the time spent on a handheld device, the greater time spent on a device the worse the health of the child.

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CONTENTS

List of Figures	3
List of tables	5
1. Introduction	6
1.1 Arguments to the negative	6
1.2 Arguments to the positive	7
1.3 Survey	7
1.4 What things can be done?	8
1.5 Thesis Outline	9
2. Literature Review	10
2.1 Introduction	10
2.2 Positive effects	10
2.2.1 Learning and education	10
2.2.2 Assisting children with disabilities	11
2.2.3 Developmental health (socialisation, friends, etc.)	12
2.2.4 Physical activity	13
2.3 Negative effects	14
2.3.1 Obesity	15
2.3.2 Brain and developmental issues	15
2.3.3 Sleeping patterns	16
2.3.4 Stranger danger	17
2.4 Parental controls, applications and devices	18
2.4.1 Notes and context	18
2.4.2 Legality of protecting children	19
2.4.3 Physical restrictions	20
2.4.4 Apps	21
2.5 Technology companies' opinions and hopes for future	24
2.6 Summary	25
2.7 Discussion	25
2.7.1 Contributions	25
2.7.2 Similar contributors	25
2.7.3 Gaps	26
2.7.4 Importance of discussion	27
2.7.5 Outcomes	27
2.8 Conclusion	28
3. Methodology	29
3.1 Introduction	29
3.2 Research Design	29
3.2.1 Survey discussion	29
3.2.1.1 Draft Survey	30
3.2.1.2 Testsurvey	30
3.2.2 Survey setup (Tablet Use for Young Children)	30
3.3 Research method	31
3.3.1 Sampling method and population	31
3.3.2 Data analysis	32
3.4 Conclusion	33
4. Facts Collected from Respondents' Answers	34
4.1 General Questions	35
4.2 Focus Questions	37

4.3 Society Questions	47
4.4 Parent Questions	55
4.5 Conclusion	58
5. Hypotheses Testing and Answering Research Questions.....	59
5.1 Introduction.....	59
5.2 Analysis	59
5.3 Conclusion	66
6. Proposing Strategies Regulating Technology Use For Children	67
6.1 Defining Policies based on Coarse Rules:	67
6.2 Conclusion	69
7. Thesis Conclusion and Discussion	70
Bibliography	71
AppendiX A: Survey.....	77
General.....	77
Focus (Children and Technology).....	77
Society	80
Focus on Parents.....	82

LIST OF FIGURES

2. Literature Review.

Figure 2.1: Elmo 1 2 3 <i>lite</i> screenshot.....	21
Figure 2.2: Elmo 1 2 3 <i>lite</i> screenshot.....	21
Figure 2.3: Sorter Screenshot.....	22
Figure 2.4: Sorter Screenshot.....	22
Figure 2.5: Club Penguin Island Advertisement	23
Figure 2.6: OurPact Advertisement.....	24
Figure 2.7 Nintendo DS Parental Control Settings Screen Example	24
Figure 2.8 Nintendo Switch Parental Control Advertisement	24

3. Methodology.

Figure3.1: Chapter 2 (Focus (Children)); Question 2.....	32
Figure3.2: Chapter 1 (General Information); Question 2.....	32
Figure3.3: Chapter 3 (Society); Question 1.....	32

4. Results.

Figure4.1: Chapter 1 (General Information); Question 1.....	35
Figure4.2. (a): Chapter 1 (General Information); Question 2.....	35
Figure4.2.(b): Chapter 1 (General Information); Question 2.....	36
Figure4.2.(c): Chapter 1 (General Information); Question 2.....	36
Figure4.2.(d): Chapter 1 (General Information); Question 2.....	37
Figure4.3: Chapter 1 (General Information); Question 3.....	37
Figure4.4: Chapter 2 (Focus(children)); Question 4.....	38
Figure4.5: Chapter 2 (Focus(children)); Question 5.....	38
Figure4.6: Chapter 2 (Focus(children)); Question 6.....	39
Figure4.7. (a): Education.....	39
Figure4.7.(b): Videos.....	39
Figure4.7. (c): Communication.....	39
Figure4.7. (d): General.....	39
Figure4.8: Chapter 2 (Focus(children)); Question 8.....	40
Figure4.9: Chapter 2 (Focus(children)); Question 9.....	40
Figure4.10: Chapter 2 (Focus(children)); Question 10.....	41
Figure4.11: Chapter 2 (Focus(children)); Question 11.....	42
Figure4.12: Chapter 2 (Focus(children)); Question 12.....	42
Figure4.13: Chapter 2 (Focus(children)); Question 13.....	43
Figure4.14: Chapter 2 (Focus(children)); Question 14.....	43
Figure4.15: Chapter 2 (Focus(children)); Question 15.....	44
Figure4.16: Chapter 2 (Focus(children)); Question 16.....	44
Figure4.17: Chapter 2 (Focus(children)); Question 17.....	45
Figure4.18: Chapter 2 (Focus(children)); Question 18.....	45
Figure4.19: Chapter 2 (Focus(children)); Question 16-18.....	46
Figure4.20: Body Size Index.....	46
Figure4.21: Chapter 2 (Focus(children)); Question 19.....	47
Figure4.22: Chapter 2 (Focus(children)); Question 20.....	47
Figure4.23: Chapter 3 (Society); Question 21.....	48
Figure4.24: Chapter 3 (Society); Question 22.....	48
Figure4.25: Chapter 3 (Society); Question 23.....	49
Figure4.26: Chapter 3 (Society); Question 24.....	49
Figure4.27: Chapter 3 (Society); Question 25.....	50
Figure4.28: Chapter 3 (Society); Question 26.....	50
Figure4.29: Chapter 3 (Society); Question 27.....	51
Figure4.30: Chapter 3 (Society); Question 28.....	51

Figure4.31: Chapter 3 (Society); Question 29.....	52
Figure4.32: Chapter 3 (Society); Question 30.....	52
Figure4.33: Chapter 3 (Society); Question 31.....	53
Figure4.34: Chapter 3 (Society); Question 32.....	53
Figure4.35: Chapter 3 (Society); Question 33.....	54
Figure4.36: Chapter 3 (Society); Question 34.....	54
Figure4.37: Chapter 3 (Society); Question 35.....	55
Figure4.38: Chapter 4 (Focus on parents); Question 36.....	55
Figure4.39: Chapter 4 (Focus on parents); Question 37.....	56
Figure4.40: Chapter 4 (Focus on parents); Question 38.....	56
Figure4.41: Chapter 4 (Focus on parents); Question 39.....	57
Figure4.42: Chapter 4 (Focus on parents); Question 40.....	57
Figure4.43: Chapter 4 (Focus on parents); Question 41.....	58
Figure4.44: Chapter 4 (Focus on parents); Question 42.....	58
5. Hypotheses Testing and Answering Research Questions	
Figure 5.1: Chapter 2 (Focus: children); Question 11.....	60
Figure 5.2: Chapter 2 (Focus: children); Question 8.....	60
Figure 5.3: Chapter 2 (Focus: children); Question 10.....	60
Figure5.4: Number of students distribution over number of hours spent on technology.....	65
6. Proposing Policies regulating Technology Use for Children.	
Figure 6.1: Body Size Index.....	67

LIST OF TABLES

5. Hypothesis Testing

Table5.1: Frequency (Focus 8)	61
Table5.2: Summary of Chi Square test for Research Question 2.....	62
Table5.3: Summary of Chi-square test for Research Question 3.....	63
Table 5.4: Rank-order Correlation	65
Table 5.5: t-test.....	66

6. Proposing Policies regulating Technology Use for Children

Table 6.1: Variables that used as parameters for linking policy recommendation element	68
Table 6.2: Coarse Rules.....	68

1. INTRODUCTION

With the recent development of handheld technology, there has been much discussion on the interaction between children and this new technology. Many are concerned about the health of children because of the many hours they are spending on these electronic devices. The usage of mobile phones and tablets by children is growing steadily around the world (Barron 2015). Some experts believe that this technology can negatively affect a child's mental and motor development because they relinquish interactive activities with peers and friends, such as playing and climbing, that support the mental and motor development of children (Radesky, Schumacher & Zuckerman 2015). However, other experts believe the opposite: instead of leading these children to become antisocial and reclusive, this technology actually encourages socialization and education. This study will discuss this issue in depth, examining the arguments of both parties to determine what can be done to benefit our next generation, focusing in particular on children who are eight years of age or less.

Handheld technology can be defined as any type of technology that can be entirely held within the hands without any external parts. This includes tablets, iPads, Smartphones, and handheld gaming devices, such as the PlayStation Portable, the Nintendo DS or the Nintendo Switch. However, this does not include devices that cannot be entirely held, such as the X Box, the Wii, the PlayStation, or PC games that attach to a television or external screen of any kind and thus have extremely limited portability.

Two main viewpoints on the positive or negative impact of handheld technology are shown below.

1.1 Arguments to the negative

These devices are one of the reasons for the deterioration of children's health and the loss of important activities that help them to grow and remain healthy, thus avoiding a number of serious health risks related to the use of these devices. Barron (2015) discusses how the excessive use of portable devices affects children's brains in her article *How Technical Devices Influence Children's Brains*. She states that children spend most of their time on the Internet and these electronic devices, such as iPads, game consoles and smart phones, instead of playing with their peers and socializing, which is detrimental to their mental and physical health. According to Barron, some neurologists have discovered dangerous effects associated with the use of these Internet devices, and so doctors are urging parents to keep these devices away from their children. They can lead to disorders in the brain, including an addiction akin to heroin and alcohol addiction, due to a lack of correct socialization in face-to-face interactions. Some studies mentioned that the addiction of children to these devices and the Internet may lead to depression.

A paper by the University of Nevada Cooperative Extensions shows an increasing number of children using media and smart devices at an early age (Kim 2013). This excessive use of handheld technology results in harmful issues for children, such as eye problems, back pain, ulcers and headaches. Kim also said that studies

show that the long hours spent by early preschool children on these smart media devices may lead to sleep problems. This paper expressly states that while there are some benefits that may be obtained from the use of handheld devices by these children, none of these benefits occur with children under the age of two years, and if such children use these devices, it will only be detrimental to their growth.

1.2 Arguments to the positive

Radesky, Schumacher and Zuckerman (2015), discuss how the use of interactive methods by children at early ages can help them to learn. Predominantly discussed in the article are children under the age of two years, but the study considers children up to primary school age. The research indicates that electronic programs, such as e-books, can help the children to learn at an early age and to develop the skills of reading, writing and understanding, as these interactive methods can be more attractive to children than other means. Some studies also found that the use of electronic devices can help to divert the attention of children when this is needed, such as in hospitals during surgery, as it can distract the children from their current situation (Radesky, et al., 2015).

The University of Sheffield conducted a study, sponsored by BBC Worldwide and the Esmée Fairbairn Foundation, titled *Digital Beginnings: Young Children's Use of Popular Culture, Media and New Technologies* that investigated the effects of media and technology on children under the age of six (Marsh et al. 2005). This study found that this technology had a positive effect on children, in relation to learning, communication and listening, after studying 1,852 parents and carers of children six and under. The key findings were that children who utilized this technology became well-socialized and cognitively well-developed, resulting in good communication, listening, literacy and critical-thinking skills, which formed good building blocks for subjects at school, such as English and mathematics.

In an article by Rettner (2016), Professor Graham Thomas, an assistant professor of psychiatry, said that there was a widespread health risk associated with hand-held technology; such as increased weight and the onset of diabetes. However, there are some popular games, such as Pokémon Go, that have had a positive effect on the user and have helped them to become more physically active, particularly in comparison to watching television screens and sitting for long periods without movement. Many experts have said this is an encouraging aspect of technology that can help children avoid the health problems related to the misuse of these devices. For instance, Professor Thomas said that Pokémon Go is currently best in its field for supporting physical fitness through gaming and technology, but there are many others that encourage fitness, such as the Nintendo Wii Fit (released 2007), and these are increasingly popular, much to the benefit of children and young adults alike.

1.3 Survey

For the research presented in this thesis to understand the general opinions of parents of young children, a survey was conducted at local schools in Saudi Arabia. It was important to consider the socio-economic level

of the schools and the parents of the attendees, though the vast majority of the locals are a part of the modern world due to the prevalence of technology in almost all cities in Saudi Arabia.

The questions in the survey included the following general themes:

- What type of handheld technology does your child use the most?
- What does your child use more, handheld devices or television/computer-based technology?
- How many hours does your child spend using handheld devices each day?

This survey was conducted to gain an accurate understanding of how this technology affects children's health in the city, as well as the parents' opinions on this topic, in order to gain a broader understanding of the topic. The survey findings could be unexpected or unprecedented, and they may bring to light arguments that this study may not have considered yet.

This research has the following main goals:

- To investigate parental awareness of health issues related to their children's use of handheld technology
- To develop recommendations for parents to support their children's use of mobile devices.

The aim is to become fully acquainted with the facts of these families and develop insights into the population as whole based on the large volume of responses. To develop such insights, the survey has been designed to develop insights into the following research questions:

Q1: What is the level of awareness and use of parental control over children's handheld devices?

Q2: What is the effect of the time spent on handheld devices on a child's academic level?

Q3: Does the use of handheld devices have a negative or positive impact on a child's health?

1.4 What things can be done?

It is necessary to take care of our children, monitor them and devise rules for the use of these devices, such as setting a specific time period to use the device, while also encouraging them to play with their friends, particularly engaging in interactive activities that will support their mental and physical development.

There are monitoring programs and applications available that can be installed on children's devices that can monitor the content that the children are consuming and the amount of time spent on the internet and on the device, and this time period can be set and limited by the parents. Parents are also recommended to encourage their children to follow the guidelines and to reward them for doing so, as this can help to preserve the child's health from the effects of these devices, especially in children under the age of eight. Parents should, in

particular, pay attention to and use the age ratings for games. There are many ways to monitor children and their use of these devices; for example, in some Windows devices, when creating an account for a child, it is possible to obtain monitoring settings from the timing mode that can prevent access to certain sites and unwanted applications, or it may be possible to get weekly reports to review the child's account (Pickerill, 2015). In smart phones and tablets, messages and calls can be backed up, so parents can remain aware of what their children are doing (Pickerill, 2015).

Overall, it is important to find a balance between devices and technology and proper socialization with other children and people. This thesis will emphasize the importance of this, and game/console designers must consider the negative effects and find innovative ways to improve content.

1.5 Thesis Outline

The rest of this thesis is organized as follows. Chapter 2 provides a literature review. In Chapter 3 the methodology of the study is explained. In Chapter 4, a presentation of the data from the responses to the survey questions is provided. Chapter 5 presents the analysis and hypothesis testing. Chapter 6 proposes policies regulating technology use for children. Chapter 7 concludes the thesis and discusses areas for future work.

2. LITERATURE REVIEW

2.1 Introduction

Today, we see the focus of technology and its diversity throughout the world. Because of this, many critics, both scientists and sceptical consumers, have concerns and reservations about this new technology, in particular handheld/portable devices, such as mobile phones, tablets and other handheld platforms, and how this technology will affect children who have access to it. Such effects include a lack of physical activity, which could result in obesity, poor mental development, anxiety and depression. However, currently there are some technologies available which can be used to counteract this negative aspect through games and devices that are beneficial to children, with benefits such as increased physical exercise, good mental health and good socialisation with other children. This chapter provides a literature review of the present studies on these topics, and it considers their validity and what information can be extracted from them.

2.2 Positive effects

Although there have been many negative effects on the health of children as a result of the development of handheld technology, there have also been many significant positive effects on children. Presented here is a review some of the studies noting such positive effects, investigating how these devices affect children. Many benefits have been found in relation to the use of technology by children (see Hatch 2011; Cristia et al. 2012; Lister 2009; Solon 2016; Fernald, Marchman & Weisleder 2013). This is relevant to the study because it shows that these devices can have many positive effects on children rather than just negative effects. These positive effects will be discussed to effectively explore the issues related to the control of children's devices.

2.2.1 Learning and education

Technology helps to develop the basic skills of children, as children who have access to technology are able to absorb information significantly better than children who cannot access such technology (Cristia et al. 2012; Hatch 2012). Therefore, such technology and electronic devices make children more interactive, active and motivated than children without. This technology can prepare students for technology-related workplaces at an early age, as job opportunities these days require technological skills (for example, one study showed that children who played video games were better at tasks that required advanced motor skills, such as keyhole surgery) (Lister 2009). These studies found that technology in education makes children more interactive, as the presentations, animation, colours and three-dimensional models can make the activities more attractive to the student (Radesky, Schumacher & Zuckerman 2015, p. 1). In this way, stories from the past that might be forgotten can remain accessible to new generations through apps and games (Ibrahim, Ahmad & Shafie 2016).

A 2012 study found that up to the age of 18 months, children and toddlers from disadvantaged or lower socio-economic families will be several months behind in language proficiency compared to other children their age. However, “with the right content and context, digital devices can help bridge the divide” (Solon 2016).

“For children aged between three and five, it’s entirely possible that a well-designed app can help improve vocabulary and basic maths skills” (Solon 2016), in that it can broaden the minds of these children and stimulate their curiosity and intelligence so that they can meet their potential (Fernald, Marchman & Weisleder 2013; Yannier et al. 2015; Hussain, Zahra & Kamal 2016). In addition to this, technology can provide a child with their own personalized workspace (Meyer 2016) for learning that can encourage them to learn new skills in a new and innovative manner.

The use of electronic devices to augment education practices is widely seen as an important tool. This point is discussed in this paper because it is important to the target demographic; it could be argued that all children at this point in their lives are looking to learn, and this technology provides greater opportunity because of the accessibility.

Hatch (2011) explained in detail, and in a clear and easy to read way, the most important effects of technology on the health of children. Lister’s (2009) article, however, pushes the point of preparing children for the workplace a little too far, as it spends a fair amount of time saying that children are simply fully fledged adults waiting to happen, without regard to the children and their actual interests. Thus, while his information is acknowledged as accurate, his dismissiveness of the children in question is also noted.

2.2.2 Assisting children with disabilities

One important point is that there are devices specially designed for classrooms that can help students with disabilities, such as changing the size of the font to facilitate reading or changing the volume of videos and other devices. With this technology, students with disabilities have been able to participate within regular classrooms rather than in specialized schools, which often have limited availability. There are also specialized handheld devices for people with special needs that can help them to communicate with other people using a keyboard that contains specialised symbols, including devices such as DynaMyte, Lightwriter or EZ-Keys (Hatch 2011; Vancouver Coastal Health 2017; McNaughton 2013; Lorah et al. 2014; Wiley et al. 2014).

Autism spectrum disorder is a significant problem with children, as it affects their developmental health and socialisation skills, but there are a number of programs in Information Communication Technologies that can help such children to interact with others. Many experiments and studies conducted to develop programs to help these children develop alongside neurotypical children (Mora-Guiard et al. 2017; Xin & Leonard 2015). This kind of handheld technology can also provide distraction for young children during anaesthesia and medical and surgical procedures (Radesky, Schumacher & Zuckerman 2015, p. 2; Garcia-Sanjuan, Jaen & Jurdi 2016; Miller et al. 2016).

With this technology and these electronic devices, it has become easier to assist people with special needs, so it is important to talk about this point and provide this important information so that everyone knows and acknowledges these developments and innovations (McNaughton 2013). “Using the data gathered by the smartphone sensors and data from wearable devices, the child can be remotely monitored by the caregivers (parents, teachers and doctors)” (Sendra et al. 2017, p. 77). Handheld technology, such as smartphones, have exponentially improved a carer’s ability to monitor patients, including children.

Smart devices such as smartphones have multimedia sensors that can help to monitor the vital signs like heartbeat rate, respiratory rate and respiratory alterations among others [10]. By one side, the accelerometers, gyroscope and GPS can help to monitor the position, movement and detect possible falls [11]. By the other side, wearable devices offer other options such as detection of seizures in epileptic patients [12] or allow the posture and activity recognition for obesity treatment [13]. (Sendra et al. 2017)

In this way, it could be suggested that technology could eventually replace general practitioners for the diagnosis of patients, but more importantly, it gives those with chronic or continued illness more independence than ever before. The development of technology and electronic devices has become an asset in terms of assisting people with special needs, particularly in relation to education and supporting daily living, helping to prevent these disabilities from becoming a barrier to them.

Assisting children with disabilities through technology and electronic devices is an important point, but should be noted that it affects a small percentage of the target demographic (though it will affect this percentage of the demographic to an arguably greater degree). This technology allows disabled children to learn and to continue with their schoolmates without feeling inferior to children of the same age due to their disabilities.

The article by Mora-Guiard et al. (2017) contains experiments and tests on children in schools that clarify the effectiveness of information and communication technology on socialization and cooperation in children with neurological disorders.

2.2.3 Developmental health (socialisation, friends, etc.)

Handheld technology, such as iPads and mobile phones, can even encourage socialisation, and thus developmental health, due to its portability and accessibility, allowing children to talk to each other easily, though some argue that this socialisation can be to the point of distraction; however, it can be argued that this encouragement of socialisation counteracts the viewpoint that the technology can cause children to be antisocial (Hatch 2011, pp. 22-24; Rowan 2013; McNaughton 2013; Morgan & Lea 2017).

Another important point is that this technology can give children access to things that they would not normally be able to access, and this can be done in a way that is even safer than just sitting them at a computer. In this way, handheld technology can be intellectually stimulating, and it provides opportunities to see more of the

world. For example, children who love animals can watch videos or play games about these creatures at their leisure, and they can choose to focus on particular aspects of them (skeletal structure, geographical environment, links between species, etc.) very easily. In this way, they can learn more, and it can even put them in touch with other children who want to learn about the same things, encouraging them to be social, or else simply give them something to talk about at school with their friends (Ito et al. 2010; McNaughton 2013).

This point about the developmental health of children is important because it helps to educate readers about how these mobile devices help children to connect with their friends in the community. The technology also helps them to develop their cognitive skills.

This type of technology provides a positive impact on children who use such devices heavily, as this technology can support children's development.

This technology is also important because it can be used to help alert parents, especially for children who need to mix with peers. These mobile devices may encourage children to be more social than children who do not have access to such technology. This benefit is highly ranked because, as with the previous point about education, it affects every child in the discussed demographic.

All these studies were valuable in clarifying the impact of technology and portable devices on the developmental health of children. These studies focused on the most commonly used applications and programs, particularly ones that children used heavily, and how they had an impact on children and their development such as video games and social media (Hatch 2011).

2.2.4 Physical activity

With the current technology, many games have become more physical than other activities. These games require children to be physically active, as they encourage children to practice movement and sport. This is very beneficial to children in order to counterbalance the periods of time when they are playing non-movement-based games or are otherwise not active. For example, this mobile technology has allowed the spread of Pokémon Go, which has had a positive impact on children, as it is an active game (actively requiring the player to move around and be active in order to play/complete the game), as opposed to sitting with handheld devices and playing games that do not require any physical activity. These new, active games seem to be on the rise, but they are not yet commonplace (Rettner 2016; Vandewater & Denis 2011).

The increase in this kind of exercise-based technology could breed a very different kind of technology, essentially solving a lot of the issues that have arisen due to the current devices. These negative effects that can be addressed include obesity (users get up and move around in designated ways; e.g., Pokémon Go requires large amounts of walking), antisocial behaviour (these games usually require/encourage socialisation (e.g., Pokémon hunting is encouraged with friends as well as "battling" with each other in order to increase points and gain prizes) and sleeping patterns (increased physical activity leads to better sleep, and some games cannot

be played at night; e.g., while Pokémon Go allows night-play, it is difficult to do so due to the requirement of extensive walking outside, which can be unsafe, something that is noted in the game) (Hatch 2011; Rowan 2009; Gould & Loria 2016; Solon, 2016). Therefore, technology that requires motion is very useful for supporting the health of children and avoiding the dangers related to these devices.

These kinds of exercise-encouraging devices are important to discuss because of the strong opposing argument. This is relevant as a certain percentage of the applications that can be downloaded on children's devices require movement and physical activity. This is beneficial for children because it strongly encourages them to do things that will help them to avoid most of the risks related to the use of devices/games that do not encourage physical activity.

Physical activity in relation to mobile devices is a major topic in today's discussion. It is important for children to move and be active in order to avoid obesity and its complications. This point is very important because many of the risks result from lack of movement, and thus the discussion of newer games and apps that elicit activity is an important benefit to consider.

The article by Rettner (2016) was useful because it explains the idea of the Pokémon Go and how to use it in detail, and it discusses its benefits as an up-and-coming game. This game reduces the risk of using electronic devices without engaging in physical activity, which can lead to the negative risks discussed below.

2.3 Negative effects

The small size of the smart devices makes them an appropriate size for children and even infants, and there are many attractive applications and games available to children of these ages. Many parents might even consider these devices a welcome distraction for their children, as they can be used to placate, stimulate or otherwise distract children as a way to take a guilt-free break from parenting (Solon 2016; Hatch 2011; Ito et al. 2010). However, studies have found that the problem with tablets is that they become more attractive to children than other activities, so there must be a balance between their use and physical activities with children and friends (Solon 2016; Hatch 2011; Oliver 2017). These portable devices are of less use to children than other activities when it comes to developmental health. The American Academy of Child and Adolescent Psychiatry has advised that children should limit the use of mobile devices from one to two hours per day (American Academy of Child and Adolescent Psychiatry 2011).

The misuse of mobile technology has had many negative effects on the health of children. One study, *Determining the Effects of Technology on Children* by Kristina Hatch of the University of Rhode Island, found that parents are highly concerned about the health of their children and how the overuse of technology can affect them (Hatch 2011).

2.3.1 Obesity

There is a major connection between the overuse of some technology and obesity (Chahal et al. 2013; Dube et al. 2017). The World Health Organisation (WHO) suggests that worldwide obesity has at least doubled since 1980, and it continues to be on the rise. Over 40 million children who are five years old or younger are considered to be obese, and this number will reach seventy million by the year 2025 if this trend continues, which can result in serious consequences (WHO 2016; Hatch 2011). A child who is obese can quite often have social and physical problems (Oliver 2017).

This technology has led to children being less active and going out less to play with their peers, and this can lead them to unhealthy increases in weight, developmental and growth issues and problems with sensory skills. Additionally, there is the ever-present risk of children misusing smart devices or excessive use, which can result in health issues or mental health problems (Hatch 2011; Vandewater & Denis 2011).

The topic of obesity is important to discuss in this paper because obesity in children is one of the most discussed negative risks due to the noted relationship between the intensive use of mobile devices and the reduction of physical activity. This point must be kept in mind in order to keep children safe from these risks. Most of the applications that children have on handheld devices do not encourage physical activity, and this results in negative consequences for children. Therefore, this should be taken into account in the future.

In an article published by WHO (2016) indicates that there is a link between obese children and the use of electronics and portable devices at an early age. The article also indicated the rate of obesity in the future if the trend continues in the same direction. This article is very clear and indicates that such risks should be avoided before they occur.

2.3.2 Brain and developmental issues

British Columbia's Society for Occupational Therapists found that the main negative effects on children's health from the heavy use of portable devices are developmental in nature (Rowan 2009). In the Society's 2009 newsletter, it was said that children relied far too heavily on technology; there was a risk of technology becoming a substitute for interaction with people, and health problems were emerging. Some studies noted that if children are deprived of interaction with people and playing with their peers, it can cause anxiety and depression early in childhood (Hatch 2011; Rowan 2009).

A well-researched article in the *Independent* by Olivia Solon pointed out that technology has a negative impact on the health of children, particularly as it affected children's brains, especially children under the age of five, in particular language and vocabulary development (Solon 2016).

There have been studies that suggest that the low levels of radiation that emanate from these devices can cause cancer and tumours, as well as other cognitive problems, such as sleeping issues and developmental delays;

however, Lennert Hardell of Orebro University, in his 2017 article *Effects of Mobile Phones on Children's and Adolescents' Health: A Commentary*, suggests that more research needs to be done before anything conclusive can be said about this theory (Hardell 2017).

The developmental issues of children are important in this paper because these portable devices can negatively affect arguably the most important part of the child: the mind. This can negatively affect the life of the child, which can lead to the child being isolated from the community around them, and this can affect their skill development and mental wellbeing. Therefore, this is an important point to discuss in this paper, particularly the reasons behind for this negative impact and what can be done about it to counteract these issues.

All of these authors seem to assume, however, that these games and devices would isolate these children rather than serve as a point of social contact. They seem to be referring, in particular, to single-player, non-social/non-party-based games, but many children still use these as a point of socialization (e.g. children often ask these kind of questions: Have you seen the latest game? Where are you up to in game? Are you really good at playing game?). Notably, this paper assumes that this is within the parameters of responsible usage rather than overuse. If children isolate themselves it is not usually the fault of the game/device and is typically due to other factors, such as depression, anxiety, bullying, abuse or other extenuating circumstances (Anxiety Disorders Association of America 2016; Gilles & Ford-Martin 2010).

It should be noted that advances in technology and mobile devices can significantly affect the minds of children at an early age, so this point is important and highly relevant for this paper. One must be careful to avoid such risks in any way possible, particularly as a parent.

2.3.3 Sleeping patterns

Another major negative effect is that the use of these devices can affect the sleeping patterns of both children and adults (Solon 2016). In order to counteract this, Apple technology, such as iPads and iPhones, have a mode called Night Shift, in which the light from the screen changes from a bluish tint to a warmer hue in order to avoid having this effect on users (Solon 2016; Gould & Loria 2016; Apple, 2017).

As use of these electronic devices continues to grow, and particularly if they are used more often in children's rooms, this can negatively affect the hours of sleep and physical activity that these children achieve. A study conducted for the online journal *Paediatric Obesity* in 2012, and another conducted for the *International Journal of Behavioural Nutrition and Physical Activity* in 2017, found that there was a major correlation between the presence of an electronic device in the child's room and sleeping less than the recommended hours. This has been found to affect health, including weight gain and consequential heart disease, hypertension and so on, particularly because these electronic devices were in the bedroom or used before sleep (Chahal et al. 2013; Dube et al. 2017).

The effect of handheld technology on children's sleeping patterns has to be discussed in this paper because these portable devices have been noted to have a negative impact, with a particular connection to sleep disorders. Therefore, parents must be aware of these risks in order to be able to protect their children effectively.

However, an increasing number of electronic devices contain programs such as Night Shift (in Apple devices), and thus it can be seen how attempts are already being made to address this negative effect. This also reflects the importance of the issue, as this would seem to be one of the fastest (if not arguably one of the easiest) fixes provided by a technology company like Apple.

Sleep is an important consideration; it is important to protect children from sleeping disorders, and related risks, due to the use of mobile and handheld devices.

Solon (2016) discusses developments in the present technology, such as Night Shift, but though this development is interesting, does it actually solve the issue of people and children staying up too late? True, there is merit to changing the lighting in order to reduce or eliminate the effect on the user's brain, but to what extent does this actually encourage users to put down their devices and sleep?

2.3.4 Stranger danger

Another major issue that needs to be discussed is the security of children online. Especially when unsupervised, children are at risk because they might not have learned about the importance of remaining anonymous online and the dangers that lurk on the internet.

A study conducted in 2008 by Lwin, Stanaland & Miyazaki, found that the parental authority has a critical role in the protection and safety of the privacy of children online, as parents have the ability to limit the disclosure of the child on the Internet. Despite the benefits offered by the Internet in terms of the development and education of children, there are concerns and fears about privacy and access to information. Unfortunately, many websites gather data and information from children without the knowledge of parents. There is extensive research showing that children are more willing than adults to provide important and personal information on the Internet, so parents must teach their children about appropriate sites as well as online security (Lwin, Stanaland, & Miyazaki, 2008).

Although there is a difference between cultures in terms of the education of children, a study published on the *Journal of Children and Media* in 2009, showed that parents and teachers cross-culturally have a great ability to raise their children and reduce the risk of exposure on the Internet. This is because the child may face varying risks, such as communication with strangers and predators who may violate the privacy of the child through either theft of personal information, inappropriate/illegal communication or other such illegal actions. Examples of this include identity thieves, scammers and hackers targeting children in order to target their parents or people who would focus on the children themselves, including kidnappers and worse (Ito et al. 2010;

Hatch 2011; Kirwil 2009). Therefore, parents must be aware in order to protect their children from the dangers of the Internet.

Presently, information is available from various sources to educate parents about these issues, but many would argue that this is not enough, particularly since parents are reluctant to discuss this aspect of security (United States Department of Justice 2016; Child Internet Safety 2017; Hatch 2011, pp. 16-17; WeLiveSecurity 2015).

Stranger danger is an important topic of discussion because it provides context for readers so that they can understand all aspects of the focus of this thesis: parental controls and applications (PC&A). By just diving straight into PC&A, readers would not necessarily have the open mind that they would have with this extra context.

When thinking about parental controls on children's handheld devices, it is important to consider all the risks. With social media on tablets, online gaming available through mobiles with player versus player (PvP) communication, etc., there is a major risk of bullying and other online dangers.

All the articles mentioned in this section were useful because they help to educate parents about the direction of their children and their children's online habits.

Stranger danger is a very important point to be discussed so that both parents are aware of this danger to their children. It is necessary to educate children and parents on such matters in order to preserve privacy and prevent thefts. This topic is considered separate from the positive and negative effects of technology with children because, though it would be considered a definite negative effect, it is assumed that there are not many children in the discussed demographic (under the age of eight) who use social media sites/apps, or if they do, it would be unusual for them to be unsupervised. This point is discussed mainly for general information and is worth noting, but many parents are already aware of this topic and thus it does not need to be expanded on.

2.4 Parental controls, applications and devices

Over the past few years, communication technology has flourished. There are many services offered by wireless communication providers, such as data access, communication, resources, applications and other features, that can benefit people's lives. However, children have become more vulnerable through messages and calls from strangers as well as to overuse or inappropriate use that can result in health issues; therefore, parents must do what they can to reduce the risks posed to their children. This can be done through the use of systems that allow parents to control certain features and services on mobile devices (Sprigg, Swart & James 2013; Hatch 2011).

2.4.1 Notes and context

Video games are now a large part of our daily lives, but there must be some restrictions and protection for young children. Many games, applications and/or devices (G/A/D) allow children to talk to strangers, including social media applications such as Snapchat, Instagram and YouTube (Instagram 2017; Snapchat 2017; YouTube 2017). Many G/A/Ds allow children to make purchases directly without permission and share them with others, including games such as Angry Birds and Candy Crush (Angry Birds 2017; Candy Crush 2017; Morgan & Lea 2017).

Luckily, there are many systems of control for parents with regards to setting game restrictions. Some responsibility is in the hands of the developers, as they must adhere to legislation that provides blanket rules that they must follow in order to release these G/A/Ds to the public (Bulger et al. 2017). One legislative method is to require developers to apply a rating system to their game, which allows online marketplaces to restrict what children can download/purchase automatically, and it also informs parents quickly about what the G/A/D content contains (Entertainment Software Rating Board 2017; Australian Classification Board 2015).

In addition, parents can limit their child's access to the Internet, such as preventing online chat or closely supervising the child's online activities and communications through these G/A/Ds (United States Department of Justice 2016; Hatch 2011; WeLiveSecurity 2015; Brito et al. 2017). This section discusses recommendations for parents so that they can be educated on this topic and can make decisions based on current information.

The topic of parental controls and restrictions is the main focus of this paper. This paper aims to educate parents on the use of the most important programs for monitoring their children, so it is essential to understand and guide both users of portable devices and parents in order to protect children and others from the related risks. This section explores many instructions and applications that help parents to monitor children with regards to the general use of handheld devices. Because children are so important, society must take care of them and make decisions based on their best interest and safety.

Notably, something that is not discussed in this paper is a child's ability to self-regulate. Whether this self-control, or lack of self-control, is due to a child's attention span, energy levels, patience or maturity. Studies have shown that children who have been taught self-regulation in non-technologically related areas will naturally have a lot of self-control and self-autonomy in such technological areas (Hiniker et al. 2017). However, adults, parents and carers are still concerned with children's accessibility and behaviours online and will look to protect them.

2.4.2 Legality of protecting children

Saudi Arabian Law

Saudi Arabia gained access to the Internet through the Governmental Centre in 1999. Currently, the government prohibits any inappropriate content for citizens, including sensitive information (whether religious

or political), political controversies or sites that violate legislation or Islamic freedoms (Electronic Frontiers 2002).

In the first two years after 1999, Saudi Arabia had a rocky start to the new technological age, as censorship was a major issue that the government was looking into. “They were worried, right from the start, that internet users could not be trusted to stay away from pornographic, gambling and other ‘undesirable’ websites” (Whitaker 2001). Their solution was to put all internet usage through a resistor-type singular computer system, in King Abdulaziz’s City of Science and Technology in Riyadh, in order to filter out the “undesirable” websites. This would in turn block out all unsavoury material, with a major public focus on pornography; however, it was also used to censor or block politically sensitive websites and documents that went against or criticized the government. This was unpopular, and the single-computer filter proved to be less than successful (Whitaker 2001).

Now, after gaining access to the Internet, Saudi Arabia has grown significantly in such areas as colleges, educational institutions and universities. The number of Internet users increased tremendously, with 100,000 Internet users in 1999 through to 16.5 million by late 2013, which makes up 55% of Saudi Arabia’s population. This growth will continue in Saudi Arabia, which means that it is necessary to develop strategies and laws to ensure the appropriate use of the Internet (Alshahrani 2016).

International Law

There are many governments around the world trying to address and restrict harmful and inappropriate content for children. There have been many policy classifications from governments for the control of the Internet. One of these categories is penal sanctions and imprisonment if highly inappropriate content was to be discovered. It also imposed blanket rules for Internet content that was not suitable for adults and young people based on the country of the consumer. There was a significant difference in access to Internet content from one country to another, and this depended on the policies and laws of each country (Electronic Frontiers 2002).

However, internationally, very few countries have any sort of censorship/protection laws in place to protect children. Overall, 22% of the responding countries to a WHO survey legally required safety restrictions and tools, including 26% of high-income countries. However, while the law did not require some countries to have such restrictions, this does not mean that there were no protective measures in place (WHO 2011, p. 53).

2.4.3 Physical restrictions

It seems to be a general consensus that parents must protect children from electronic devices, and this paper is focusing on the apps and software/developer/marketplace guidelines that can help guardians to do so. However, another important point that should be mentioned, even though it will not be delved into very deeply, is that the most commonplace method for enforcing rules for children is physical restrictions. This refers to physical restrictions and rules enforced by parents rather than virtual/online/app-based restrictions. Examples include a parent confiscating all technological devices from a child at bed time, to be returned the next day, or

not allowing such devices in bedrooms. These methods are effective for things like time restrictions, but they are less effective in terms of supervising actions during the time with devices.

2.4.4 Apps

Some systems allow applications that add parental controls through the use of settings, so a child's profile can be protected by a password that ensure that the child can only play games based on appropriate age classifications. Some automatic restrictions, such as classification systems, aim to prevent inappropriate games from being downloaded directly for various reasons, mostly in order to protect children from inappropriate content, such as violent or sexual content.

Other control systems prevent the child from sharing personal information, either through the Internet or other sharing methods. Other programs exist that alert parents by registering websites that the child visits or by sending warning messages regarding the content visited by the child (Federal Trade Commission n.d.).

Apps focused on children

There are many ways to support a child's education beyond school, as there are many applications or games that can be downloaded on handheld devices, such as mobile phones or tablets. The following apps will be examined based on three different categories: education, physical activity and stranger danger. It will also note whether the app is free, has a free trial or requires funds to purchase.

- **Elmo Loves 123s Lite**

Elmo Loves 123s is a free application that helps children to identify and define numbers from 1 to 20 and perform some simple arithmetic operations, such as addition and subtraction. This application is good because it is free to download by Astor, which is considered to be highly safe for children because it is an educational app; it offers surprising videos, linguistics lessons and colouring pages that help the child to learn and become literate. The characters from the famous television show *Sesame Street* interact and teach the children quickly, especially for children aged five and under (Brandt et al. 2017; Sesame Street 2017). *Elmo Loves 123sLite* does not address the category of physical activity and has no stranger danger, as it is not an app that can be used to communicate with others in any format. However, this does not detract from the app, and it is recommended for young children.

Figure 2.1: Elmo Loves 123s lite screenshot
has been removed due to copyright restrictions.

Figure 2.2: Elmo Loves 123s lite screenshot)
has been removed due to copyright restrictions.

- Sorter

Free Toddler Educational Learning Games for Kids, Boys and Baby's Sorter helps children to distinguish between shapes and colours and to sort them by a single touch. This application is very useful for early learning. This ranks it very highly in the educational category, but once again it has neither a physical activity aspect, nor does it pose a risk in terms of stranger danger. An important point to note is that the free trial version has direct links back to the App Store so that the full version can be purchased, which is a financial risk (Belikova 2017).

Figure 2.3: Sorter Screenshot has been removed due to copyright restrictions.

Figure 2.4: Sorter Screenshot has been removed due to copyright restrictions.

Club Penguin Island

With varying age recommendations starting from 7+, *Club Penguin*, and its later spinoff mobile game *Club Penguin Island*, is a social media website run by Disney for children. Children can communicate with friends and make new ones by interacting with other users through penguin-shaped personas. In order to protect the children online, the games are highly and strictly monitored through the coding as well as by moderators. These restrictions include using keywords (i.e., if the child uses a bad word when communicating with someone, the word would be flagged and trigger an automatic ban for a certain amount of time) and personal information (monitored by moderators and programmers). Another option is that parents can restrict children to a set list of words and phrases, thus minimising their risks online. Based on this, the game has a risk in the stranger danger category, but it has effectively minimised it. There is little engagement on the physical and education level, beyond smaller minigames within the larger game, and it does have in-game purchases, but it warns the user each time before they purchase anything (Disney 2017; Google n.d.).

Figure 2.5: Club Penguin Island Advertisement has been removed due to copyright restrictions.

Parental Control Apps

Parents play a major role in protecting children from the dangers related to the heavy use of electronic devices. Some of the primary ways that have been used to protect children in marketplaces, such as Apple's App Store and Android's Google Play, include the following:

- requiring a sign-in to download applications
- requiring a connection to a credit/debit card
- requiring developers to adhere to a rating system, and then allowing users to block certain ratings
- requiring all downloads to have certain permissions (from other accounts, from owners of (group) accounts, etc.)

In this way, it can be seen that marketplaces have made some effort to protect children from inappropriate material, but this is not 100% effective (Apple 2017).

The most important of these tools: prohibition and filtering. This tool helps to prevent access to inappropriate material. Within the control tools, the content issued by these devices can be prohibited. These programs allow parents to set a specific time for their child on the Internet and other such restrictions (Federal Trade Commission 2011).

- OurPact

One example of an app that can control children's devices is *OurPact*, which can determine the number of hours allowed for the child to use the device and then cut off the Internet or shut down specific applications after the specified period set by the parent.

One of the advantages of this application is that it allows parents to create a fixed schedule so that the screen is blocked during times intended for sleep, homework and family. With this application, parents might find that children are less distracted because of the schedule for their devices (OurPact 2016).

Figure 2.6: OurPact Advertisement *has been removed due to copyright restrictions.*

- **Nintendo's Parental Control Settings**

The latest device from the popular gaming company Nintendo, the Switch, has some rules of use and parental controls available to help ensure a fun experience with less worry and danger. This application enables parents to set time limits or control game usage through ratings. Parents can also get monthly reports that show the most played games and how many times a child plays each day (Nintendo 2017; Crisp 2017).

Figure 2.7 Nintendo DS Parental Control Settings Screen Example *has been removed due to copyright restrictions.*

Figure 2.8 Nintendo Switch Parental Control Advertisement *has been removed due to copyright restrictions.*

Older versions of Nintendo's devices, such as the various models of the DS and the WiiU, have parental control options within the device itself, and once enabled, they require a passcode from the parents to change the settings. However, there was no app option available, and the Switch continues to take broad strides into the technological age (Nintendo n.d.; Parental Controls n.d.).

2.5 Technology companies' opinions and hopes for future

Some experts argue that as more awareness is brought to these negative aspects, then technology companies will step up to bat and find ways to address them, so that children (along with the rest of the world) will be

able to safely use such technology without ill effects. This could be considered a major step as the world becomes more and more technology-based, as everything from watches to the weather forecasting to deliveries become automated. Cornelia Brunner, advisor to Wireless Generation, Inc., states that “we have to be moral in the digital world, just as we do in the real world” (Hatch 2011), so that we can maintain mental and physical health through the responsible use of technology, and this need will continue into the future. However, some consider that our children will eventually become cyborgs, completely integrated into technology with all the side-effects consuming their lives.

Thanks to the internet and the ability of the transmitter, there is a lot of data and information that we, as the public, can access easily, such as temperature and weather data. This is through developments in technology that may, in the future, measure a baby's heartbeat and weight. This means technology may be everywhere, which in some eyes may be seen as immersion in technology to the point of drowning (Unwin 2016). However, through responsible usage, the future is not so frighteningly square-screened and debilitating.

2.6 Summary

Applications are the main focus of this paper. The G/A/Ds in question may elicit the need for these apps due to concerns about their negative effects. Parents need to be educated about the effective parental control apps, and this topic will be approached based on two different categories: apps focused on the children (the G/A/Ds themselves) and parental control apps (external apps that are focused on controlling the children's devices).

All these applications have many advantages and disadvantages, as they can develop a child's skills and behaviour but at the same time negatively affect the security and health of the child. It is important to discuss this aspect in the paper to ensure readers are aware of this and to educate them about what can be done to protect their children.

2.7 Discussion

2.7.1 Contributions

I have presented in this paper most of the positive and negative effects of handheld devices on children 8 years old or younger. These are the most common effects resulting from the intensive use of portable electronic devices. The purpose of this paper is to advise its target audience, parents of young children, about modern methods to encourage responsible usage of handheld technology, including mobile games and online games, whilst investigating the considerations for companies of said technology to address in order to ensure that children can be protected and monitored responsibly.

2.7.2 Similar contributors

The World Health Organisation has published a document which discussed topics akin to the ones in this paper; and thus, this paper has been able to draw on information from WHO to support its arguments. WHO provides

extensive facts on what has been observed in recent years with regards to the dangerous health effects on children as a result of the use of electronic devices. It has provided some safety and security suggestions for the Internet, due to children having easy access to the Internet these days (WHO 2011). However, findings were not discussed in great detail, so this paper is filling this gap.

Kristina Hatch also discussed a similar topic in her paper *Determining the Effects of Technology on Children* in 2011, as she discussed both the negative and positive aspects of the use of technology and portable devices in relation to children. Her work provided supportive evidence on many of the points discussed regarding both the negative and positive aspects, though she was less specific about her target age group. One of her surveys was completed by adults with regards to children, while the other was completed by high schoolers, who were questioned about both their opinions and their history with technology, but overall her study covered from toddlers to adults and discussed all arguments.

Jenny Radesky, Jayna Schumacher, and Barry Zuckerman's article *Mobile and Interactive Media Use by Young Children: The Good, the Bad, and the Unknown* for the journal *Pediatrics Perspectives* in 2015 focused on children—"infants, toddlers, and preschool-aged children"—and their interaction with media and mobile devices. The paper argued for the positive impact of technology on children through its exploration of such television shows as *Sesame Street* and *Blues Clues*, which intellectually stimulate children. The article has an age bracket that is similar to this study's, as the study focused on young children who were not yet of school age.

Olivia Solon's 2016 article *Does Spending Too Much Time on Smartphones and Tablets Damage Kids' Development?* is similar to this paper's study in terms of presenting the effect of technology on the health of very young children, particularly in relation to the intensive use of devices. This study is similar to our own research and arguments in many of the points discussed, and it has good references to reputable studies, which made for a convincing argument.

2.7.3 Gaps

Gaps in the current research include information specifically about children aged eight and under in relation to handheld technology. Other gaps include handheld technology (as opposed to non-portable technology, such as televisions and computers).

It was difficult to obtain information on children aged eight and under because most of the previous studies discussed the effect of devices on children under the age of ten or on teenagers. This paper presented the most important aspects with regards to the use of technology for the selected age group: aged eight and under. This age group was selected because of the growing concern among parents in recent years following advances in technology. This age group consists mostly of children who do not yet have their own mobile phones (for the purposes of communication) but who are starting to have varying levels of freedom online, while at the same time, this is when children are at their most vulnerable (for the reasons discussed previously).

In addition to this, it was difficult to obtain information regarding *handheld* technology and mobile devices, such as smart phones, iPads, and gaming devices, as most of the research has focused on electronic devices in general, including televisions and computers. Therefore, this paper discussed the gap in the recent research in terms of the age group and the type of mobile devices; however, while this thesis does not focus on television and other non-portable devices, it does draw references from them, at times.

At the time of this study, there is little research available on Saudi Arabia in the context of children, technology and regulations. In this way, this paper may very well be breaking new (if quite specific) ground. The review of the results of this study will be discussed later in the results and discussion section, where the full context is available.

2.7.4 Importance of discussion

Media, and particularly social media, are increasingly being used by children. Therefore, guidance should be provided to parents to understand this means of social communication so that they can monitor their children and ensure their safety. The purpose in this sharing of information is to educate and guide parents and to investigate some of the proposed solutions for this issue. Social media, such as Facebook, Twitter and Instagram, are more popular among parents. A large number of parents upload their children's pictures on these programs, and even underage children having a presence. These tools offer many benefits for families with children, such as directing and alerting parents about issues that might affect the health of children (Keith & Steinberg 2017).

It is important for parents to be aware of the potential health risks to their children because of this technology. This study encourages parents to develop rules for children regarding these mobile devices to avoid many of the related health problems, which are becoming prevalent in countries around the world. Parents are encouraged to use control programs that will promote child safety or enforce physical rules.

This paper is also important for stakeholders from Tech companies and technology designers, as it encourages them to consider underage consumers and implement features in future devices that can help prevent negative effects.

2.7.5 Outcomes

This paper is directed towards a demographic of parents with young children, but there is important information for technology companies, as well, which they are encouraged to take on board. Findings from this paper could be utilised by developers to design better parental control applications for mobile devices or to develop child-friendly applications or games that encourage physical activity or support education.

2.8 Conclusion

“So instead of criticising devices, perhaps we should be demanding better apps built on solid research” (Solon 2016). In conclusion, this chapter discussed some of the positive and negative effects of mobile devices on the health of children aged 8 years and less, as this age group has been a major concern for parents around the world. It has been found that these devices can have a positive impact on children, such as supporting education, encouraging physical activity and cultivating skills. On the other hand, these devices can also have a negative impact on children, with consequences such as obesity, sleep disorders and brain problems. This chapter also discussed the role of parents in protecting their children through the use of certain parental control applications or by establishing rules that help to protect children from these dangers, and it also discussed the role of designers and software developers.

Next, this paper will discuss the methodology of the survey.

3. METHODOLOGY

3.1 Introduction

The previous chapter discussed the impact of handheld electronic devices on the health of young children and how a parent can effectively regulate a child's time on these devices. This chapter discusses the research survey and its methods. A description of the sample used is given, and the tools used in the study are explained. Moreover, this chapter discusses the problems encountered during the study and how they were solved.

3.2 Research Design

A survey has been selected to gather data on the impact of electronic devices on the health of children. The survey questions range from general questions to questions about children and technology to questions for parents. The variety of questions was important for gathering as much information as possible and to obtain clear and plentiful data. The survey was developed using SurveyMonkey, a useful and easy tool for creating surveys that can be easily accessed through an online link, which can be issued after the survey has been completed. SurveyMonkey also provides quick and easy data analysis, which will be utilized along with SPSS so that a full analysis can be done.

3.2.1 Survey discussion

Surveys are a popular method for obtaining desired information from a large number of people. However, it is important to keep in mind the specific target demographic so that the survey can obtain reliable and accurate results from the specific sample. In this research, the survey was distributed to parents who had children aged eight and under in order to obtain clear and accurate information on the extent of the effect of devices on the health of children. The researchers were unable to directly communicate with the children in question due to their age, but this was not an issue, as the children in question would most likely have been unable to produce answers to certain questions in the survey. For example, it is highly unlikely that a toddler would be able to answer questions about their society or their socio-economic level.

The data and survey distribution for this research was performed by sending the survey via e-mail to the children's parents. Notably, the parents were not required to answer the survey, and this makes the person who answers the questions freer, making the data more accurate. If parents did not wish to complete the survey, then they did not have to reply to the email or read the questionnaire.

One of the most important steps is to develop a plan for designing the survey in the best format so that it can obtain the data without harassing the parents or making the survey too long. As a result, it took a long time to develop this survey and ensure that the questions had high validity, the obtained data would be correct and the survey used the most efficient number of questions.

Planning is an important step at the beginning of a survey. One of the most important tasks is to create an initial draft of the survey before creating the final survey, which will allow some feedback to be gathered and mistakes to be discovered so that they can be avoided in the final survey. This is important for avoiding many of the problems that occur in surveys.

3.2.1.1 Draft Survey

In the setup of the *Tablet Use for Young Children* survey, a much smaller draft survey was created, simply called *testsurvey*. This short, five-question survey discussed food, (“What is your favourite food?” “On a scale of one to ten, how much do you like vegetables?”, for example) and gave researchers a lot of knowledge as to, firstly, how to navigate SurveyMonkey using a variety of types of questions (i.e. textbox answer questions, rating scale questions, etc.), and then how to analyse the data at the end of it. A small handful of randomly selected people completed the short survey, and results were drawn.

3.2.1.2 Testsurvey

Initially, SurveyMonkey was not something that researchers for this paper had experience using. *Testsurvey* was used in order to gain understanding about how to use SurveyMonkey, such as the possibility of changing the language to Arabic and other languages, dividing the questions into many chapters (“pages”), and a better general understanding as to the different types of questions with the possibility of adding pictures. In this way a variety of differently styled questions could be utilized to the best of their abilities. Experimental testing is suggested to be very useful for researchers, as they can face many difficulties at the beginning of research, especially when using new technology for this research. This approach triggers obvious problems and difficulties in a controlled environment so that potential solutions can be evaluated in order to find the most effective solution without affecting the main survey. An example of this is that the survey creation was difficult in regards to selecting the most appropriate type or style of questions due to the variety of styles (examples of which can be seen below). However, with the utilization of *testsurvey* and testing out the variety available this issue was quickly smoothed out. In this way *Testsurvey* was used so that a better understanding of SurveyMonkey could be attained, and done in a fashion that would not have affected the final survey (*Tablet Use for Young Children*).

3.2.2 Survey setup (Tablet Use for Young Children)

The survey is broken up into four sections: general, focus (children and technology), society and parents.

General

In the General section, there were demographic questions about the residential neighbourhood in which the child lives, the number of children in the family and their ages. This section provides context for the rest of the questions and background information on the children in question, as this will help us understand whether age, gender and grade average at school are contributing factors for these children. From this section, it can be

determined whether the number of children in a family, or the socio-economic background of the family, has an effect on the amount of interaction with handheld technology (henceforth “screen-time”).

Focus (Children and Technology)

The second section focuses on children and technology, and it contains questions on the types of applications or games used by the children, the reasons the children are using them, how much time the children spend on mobile devices and any physical problems that the children are experiencing. These questions give us a great overall understanding of what these children are like and should provide results on whether there is a connection between effects, such as being overweight, and overuse of screen-time. This is the most important part of the survey, and should provide a lot of highly useful, relevant information from the survey answers.

Society

The third section focuses on society, in particular the parents’ opinions of their children’s world and how this might affect the children. This is done using such questions as “Children are at risk of mental and physical harm when they play on these devices. Do you agree or disagree?” and “Children’s social skills can be positively affected by technology. Do you agree or disagree?” In this way, the mindset of the parents can be understood, which could also give these parents new thinking points on topics such as stranger danger and the relationship between screen-time and education. The results may show causes of excess screen-time that the research did not initially show, and addresses a wide spectrum of information so that a better understanding can be reached.

Parents

This section includes questions on the types of devices that the parents use, their jobs and their education levels. All these questions are important in understanding the impact of electronic devices on young children; if we can understand the parents, then we have a great starting point for understanding the children. It is for this reason that the research is being performed, as parents should be educated about such things in order to protect their children from the pervasive dangers online.

Overall, these questions should result in answers that show a range of connections to potential causes of the negative effects of excess screen-time; at the very least, they should be a starting point for new, cutting-edge research.

3.3 Research method

3.3.1 Sampling method and population

This research uses a survey, which will be distributed in a number of Saudi Arabian schools; the administration at these schools sends an electronic link to the survey to the parents of students who are eight years old or less. Parents will hopefully answer the survey questions, and SurveyMonkey will automatically collect and compile the data in the results database. This is the best way to get the data and information needed by the researcher.

3.3.2 Data analysis

SurveyMonkey is a tool for publishing surveys on the Internet for the purpose of gathering data. The features provided in SurveyMonkey help researchers to publish surveys online and access results in real time, and it also has the capability of analysing large amounts of data and information. SurveyMonkey can fill out questionnaires through a single account, which saves a lot of trouble for the researcher if they do not have to do manual analysis. It also offers the best encrypted survey platform to ensure data and information security (Evans et al. 2009).

As noted, the SurveyMonkey program has an easy interface and variety of question methods, such as the following, which are all taken from *Tablet Use for Young Children Survey* (Alfaez 2017):

2. Your children all have similar devices. Do you agree or disagree?

I strongly agree	I agree	I neither agree nor disagree	I disagree	I strongly disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 3.1: Chapter 2 (Focus [Children]); Question 2

2. Please list your child's details. (Age, gender)

	Age	Gender	Grade average at school
1	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>
4	<input type="text"/>	<input type="text"/>	<input type="text"/>
5	<input type="text"/>	<input type="text"/>	<input type="text"/>

Figure 3.2: Chapter 1 (General Information); Question 2

1. In two to three sentences, what is your opinion of mobile devices on children in society?

Figure 3.3: Chapter 3 (Society); Question 1

This diversity in questions helps the researcher when collecting data and also during analysis. This is so that participants can choose from many of the choices in the list, add a simple text comment, a short sentence and so on. All of this is useful for the researcher during the final analysis.

Another benefit of having such a variety of questions is that it helps in retaining the attention of the survey takers. In total, there were 42 questions in *Tablet Use for Young Children*, and if all of them were multiple-choice or short-answer questions, then the survey participants would quickly lose interest and leave the survey incomplete. For example, the “similar devices” question from Chapter 2 (Focus [Technology]) has a rating scale of “Strongly Agree” to “Strongly Disagree”, which differs greatly from the “mobile devices” question (from Chapter 3 [Society]), which is a short-answer question.

SPSS

The data display in the SPSS program is a table consisting of columns and rows, and the researcher inserts the data into the table either manually or by importing them from the data files. Luckily, SurveyMonkey has easily exportable data files, which makes this process simple.

SPSS can read the information packets, but it is preferable for the program to change the majority of the information to numeric variables. This means that the processors may not be able to pick out the “overall idea” of some of the short-answer questions, but they will instead most likely use keyword scanning to check how many people (for example) “strongly agreed” with the relevant questions in order to analyse patterns. For example, in looking at questions with answers like Yes/no, Male/Female, Strongly Agree/Agree/Neither Agree nor Disagree/Disagree/Strongly Disagree, the SPSS will utilise numerical codes in the information record, such as 1 – Yes and 2 – No (eduCBA 2016). In this way, patterns can be easily found and analysed.

Expected results

My hypothesis is as follows: there is both a positive and a negative impact on the health of children as a result of the intensive use of mobile devices. Extensive use is now common in our communities due to the developments in electronics, but there are many concerns that the negative effects outweigh the positive effects, particularly for children eight and under. The expected results include how the use of the handheld devices increased a child’s academic level. It is also expected that level of awareness and use of parental control over children’s handheld device will not affect children’s academic performance.

3.4 Conclusion

This survey is a method of polling that is going to be distributed to the primary schools in the Kingdom of Saudi Arabia through an electronic link via SurveyMonkey. This chapter explains the survey method in terms of the diversity of questions, and it anticipates some of the potential problems that the research might face. The survey includes a variety of questions, such as rating and open questions. The analysis of this data after its completion will be done using SPSS. This program will allow us to show the results of the survey, which will be analysed in the next chapter in detail.

4. FACTS COLLECTED FROM RESPONDENTS' ANSWERS

An online survey was created consisting of forty-two questions. These questions were used to collect information to serve the study's two main objectives. The first objective is to provide a broad analysis and clarification of answers in relation to personal and familial demographic facts, technology-use habits, health side-effects on children, and the perceptions of technology by these children's parents. The second objective is to use the data for formulated hypotheses testing. For each question, an attempt was made to select the most suitable visualization graph that can provide high-level illustrations and convey the underlying information of the collected responses. Most questions are multiple choice, with the others being open-ended, choosing one of numerous possible answers or range slider to enter a continuous value such as percent's that lies between 0.0 and 100.0%.

The survey questions can be divided into each of the following categories:

- **General Questions:** this category aims to collect broad information about family location, and information about each child in the family (i.e., age, gender, grade average at school).
- **Focus Questions:** this category includes a variety of questions about the children (e.g., health, time spent, level of parental control, etc.)
- **Society Questions:** this category deals with technology and children's interaction with the surrounding society. Here, parents can reveal their opinion on how their children interact with society as well as their sentiment toward such interactions.
- **Parent Questions:** this category includes the parents' demographic information such as age, time spent using technology, and education level.

The categories, the questions within these categories, and the responses to said questions are listed below.

4.1 General Questions

Postcode of Families Surveyed

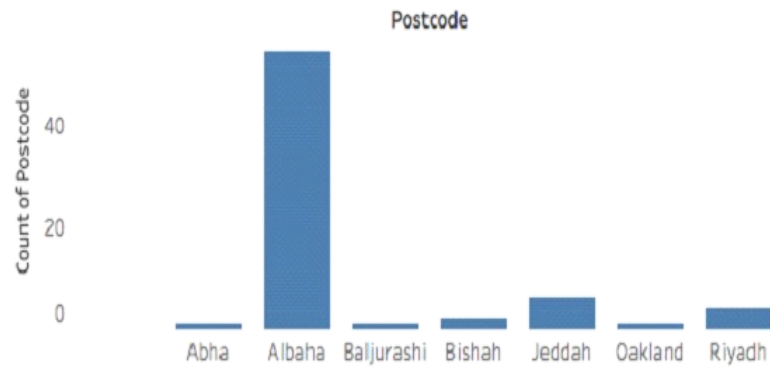


Figure 4.1: Chapter 1 (General Information); Question 1: Demographic Distribution of Respondents

In *Figure 4.1*, nearly, 72% of respondents are from Albaha City, followed by Jeddah and Riyadh (10%). The rest are negligible as they are located across three other cities.

Distribution of Children per Family

The study indicates the number of children per family. Nearly 58% of families had one child, 13% two, 11% three, 10% four, and 8% five. The study encompasses 71 families with 111 children.

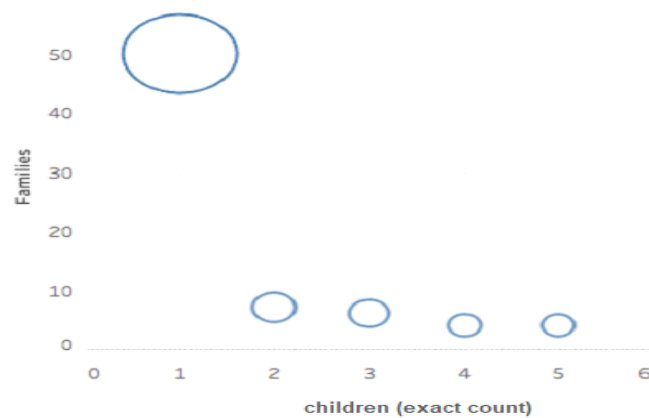


Figure 4.2 (a): Chapter 1 (General Information); Question 2: Family Size of Respondents

Total number of children = 111.

Age distribution of kids:

The study aims to shed light on all children’s ages. In *Figure 4.2 (b)*, a tree map as a method of visualization is presented, where block size correlates with children’s count per age. It can be seen that children aged 13 have the largest block, while the study was focused on young children (8 years and under) limitations with the study resolved into a wider population pool.

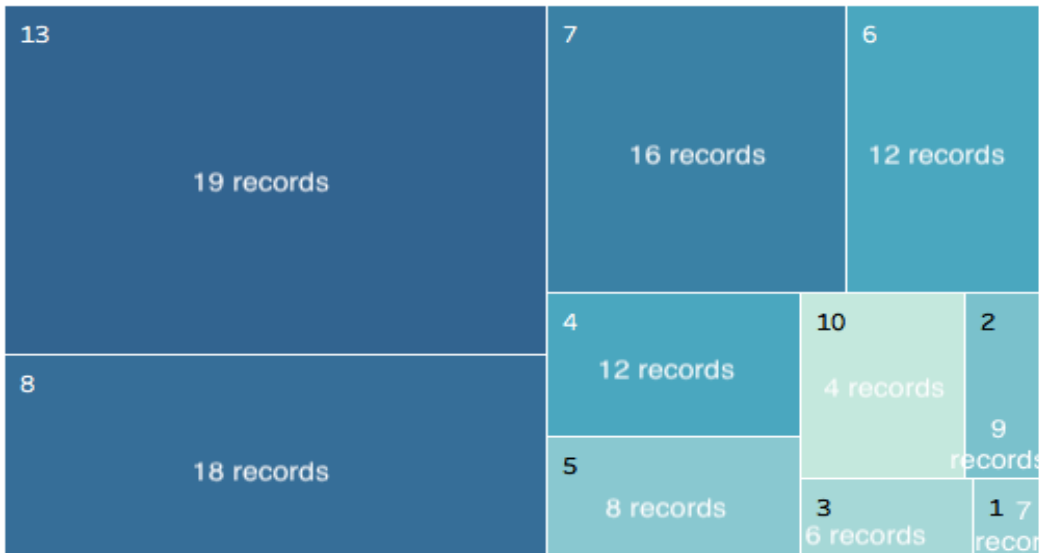


Figure 4.2 (b): Chapter 1 (General Information); Question 2

Figure 4.2 (c), charts the percentage of females as 51.4% and males as 48.6%. This finding reflects the true population as the male to female ratio is close to 1:1.

Male/Female

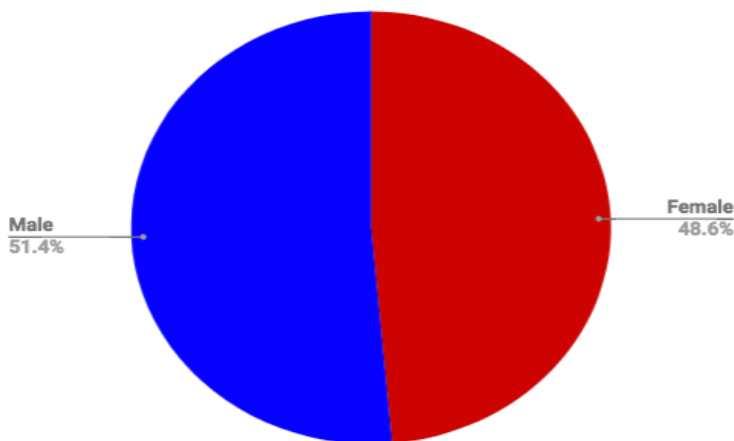


Figure 4.2 (c): Chapter 1 (General Information); Question 2

Note from the next figure that the number of children ranging between the ages of 8 and 10 are among the highest. Such findings fit with the number of students found in *Figure 4.2 (b)*.

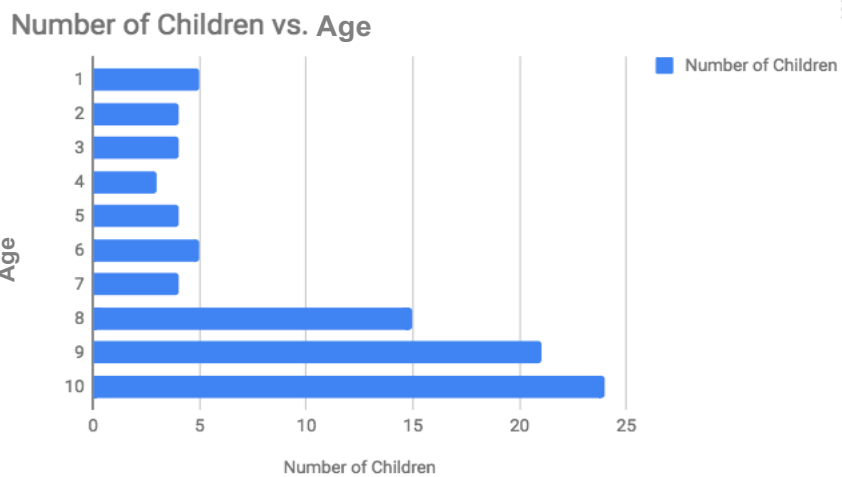


Figure 4.2 (d): Chapter 1 (General Information); Question 2

4.2 Focus Questions

Focus 3:

This graph indicates that there is a variety of answers, but the majority of parents said that their children have exactly equal access to technological handheld devices.

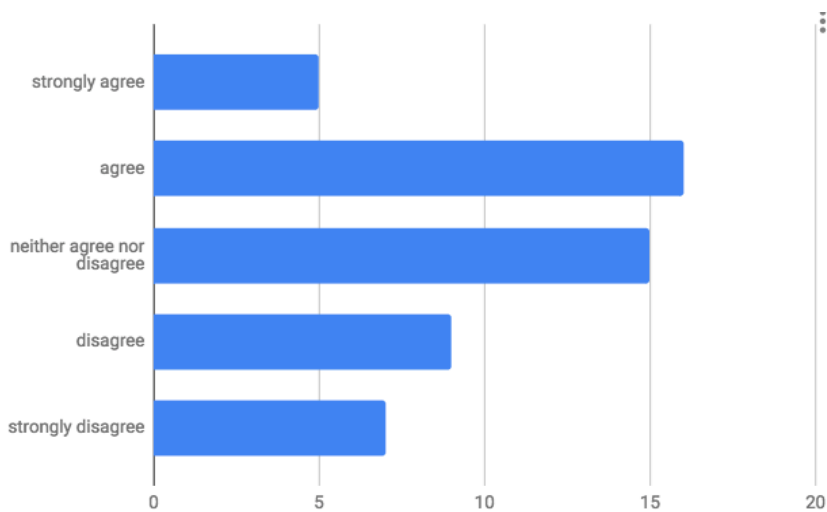


Figure 4.3: Chapter 1 (General Information); Question 3

Focus 4:

From the following graph, it can be seen how parent’s answers move from agreeing to disagreeing. Nonetheless, the percentage of those who approved was higher.

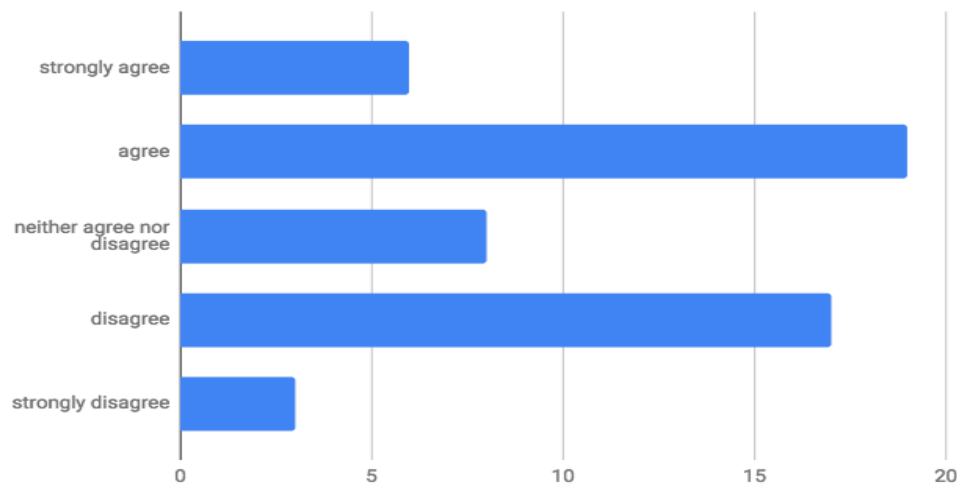


Figure 4.4: Chapter 2 (Focus: children); Question 4

Focus 5:

Most of the children’s devices that are used when the children are under the age of 8 years are the iPad and tablet (45.1%). Smartphone use was at 37.3%. These two types of devices were the most common.

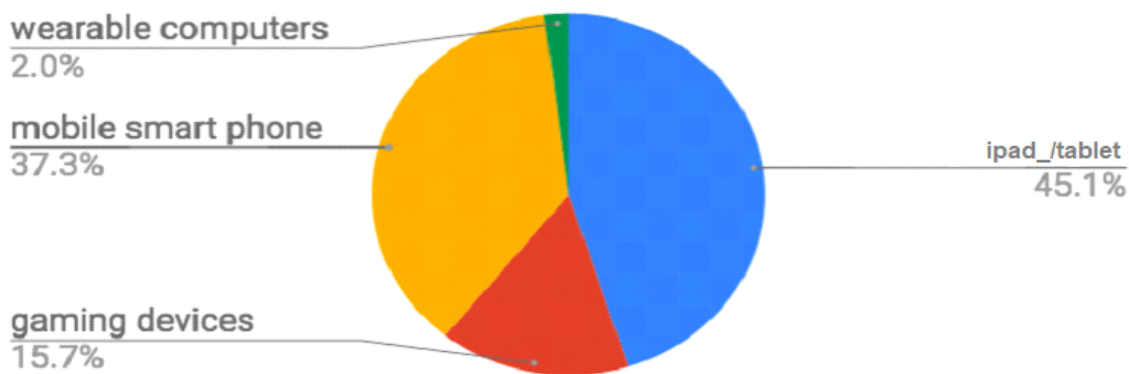


Figure 4.5: Chapter 2 (Focus: children); Question 5

Focus 6:

Through the word-cloud plot, the words with the largest fonts indicate a frequency across parent’s answers and consequently the importance of these words. Colour codes are assigned to each word randomly for better visibility. Generally, there is a variety of applications and games used by children such as educational aps and entertainment aps. Interestingly, the most used application by children is YouTube because of its outreach and YouTube’s wide range of videos suiting different purposes (e.g., entertainment, education, training, etc.).

Focus 8:

From the graph, it can be seen that parents check their children’s technological equipment regularly: either once a day or once a week. Some parents checked their children’s technological equipment only once a month or every six months.

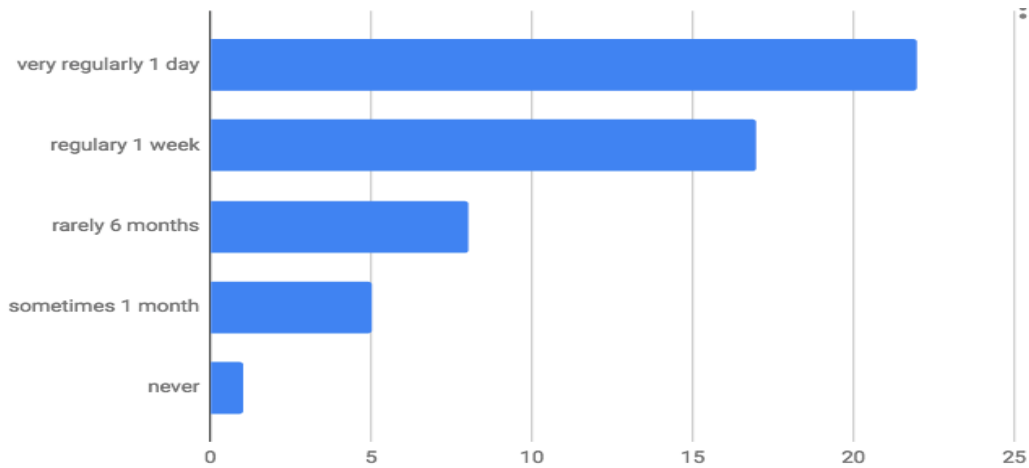


Figure 4.8: Chapter 2 (Focus: children); Question 8

Focus 9:

This diagram shows the different forms of parental control concerning their children’s technological activities. This control was carried out by regularly checking their devices or by limiting their time on the devices.

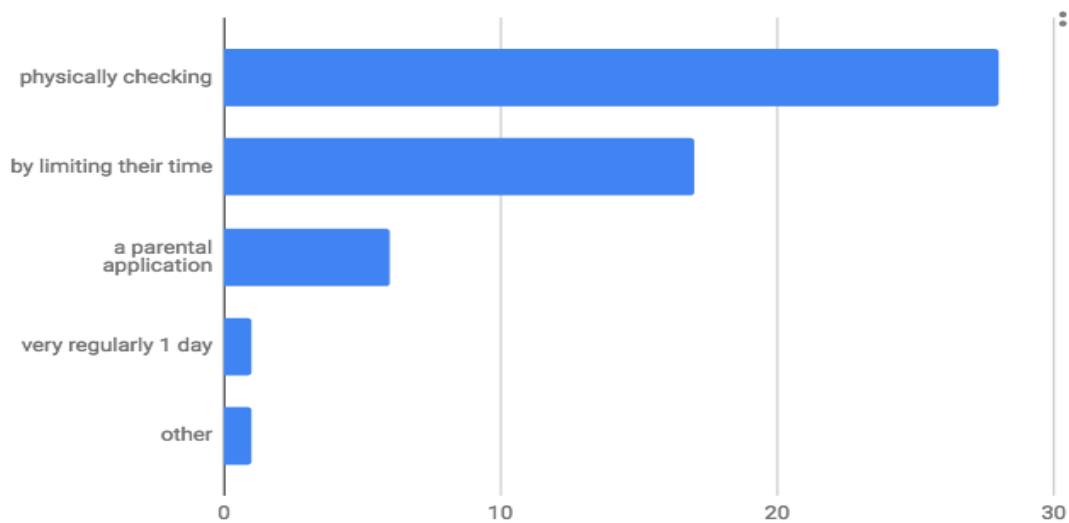


Figure 4.9: Chapter 2 (Focus: children); Question 9

Focus 10:

More than 30% of parents intentionally use parental control, and the app market has noticeably provided a variety of applications serving this particular need. Such apps can serve parents' needs for blocking the undesirable download of apps (e.g., gaming and chatting) on their children's devices and restricting the time spent on handheld devices. The parent can also be tracking their children's activities on handheld devices (even if a family has many devices). Our data shows that there is no consensus on the types of apps used by parents, suggesting no prominent app over others. The parental choice of apps is diverse, which implies that the type of control may differ from one family to another. Figure 4.10 shows the apps that parents use to control their children's devices.



Figure 4.10: Chapter 2 (Focus: children); Question 10

Focus 11:

The following figure explains the amount of freedom parents give their children when using devices / applications / games. Note from this figure that most parents do not allow their children to use applications / games / devices that are not allowed by the family. The parents also regularly check their children's devices, even after they have given permission to download various things. This means that the child does not enjoy complete freedom over their device and that there is strong parental control over the children's devices.

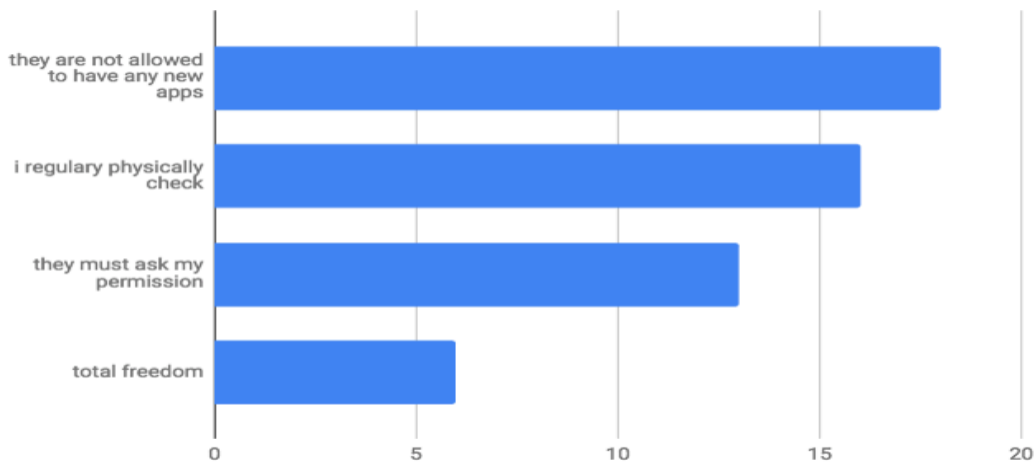


Figure 4.11: Chapter 2 (Focus: children); Question 11

Focus 12:

The following bar chart shows how much time each day children spend on electronic devices. Most children spend from half an hour to an hour while the same amount spend one to two hours. Fewer children spend two to three hours on their devices.

Note: some parents also said that their child used a device once a day or on the weekend.

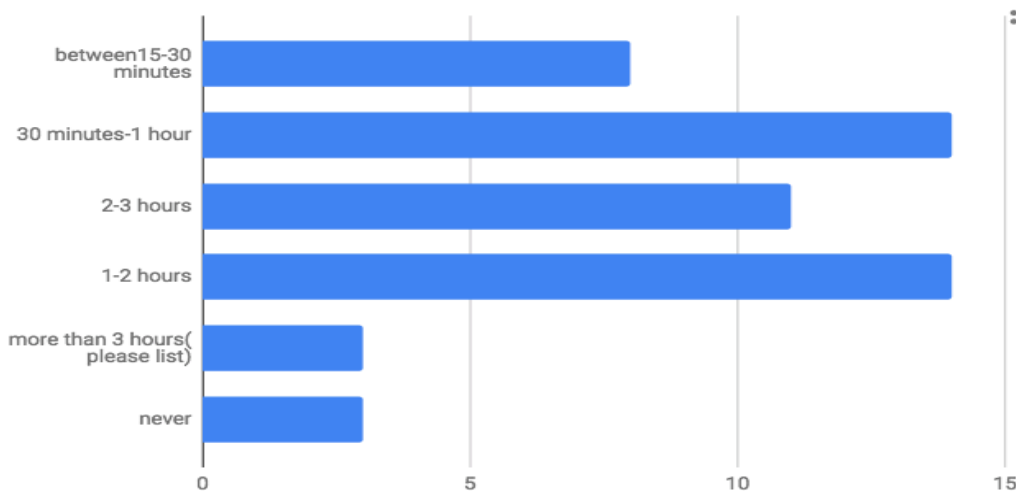


Figure 4.12: Chapter 2 (Focus: children); Question 12

Focus 13:

This figure shows the physical problems experienced by children as a result of too much technology-use. The problems include a lack of exercise and poor social relationships. It appeared to us that eye and movement problems are more common than other problems such as weight and sleep.

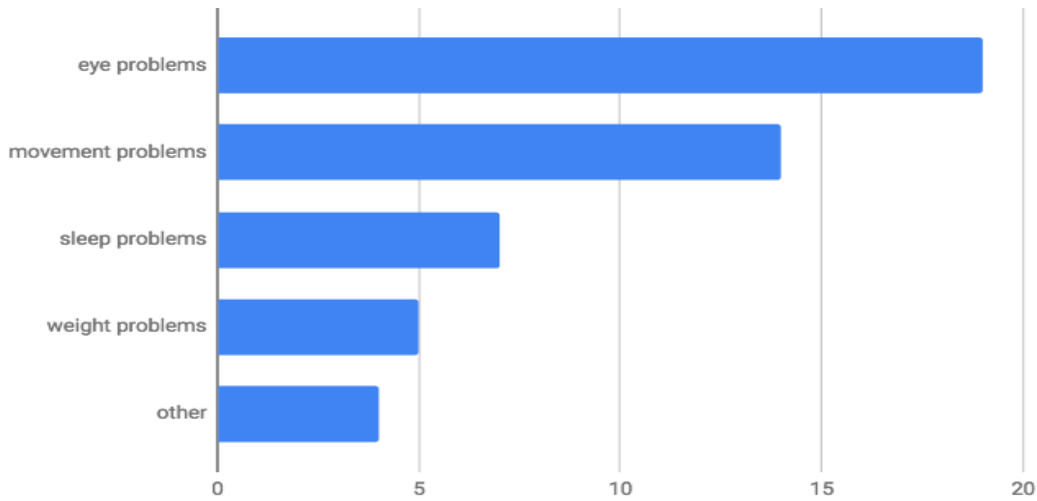


Figure 4.13: Chapter 2 (Focus: children); Question 13

Focus 14:

This diagram explains how old the child typically is when they begin to use handheld devices. Most of the answers ranged from 3 to 6 years.

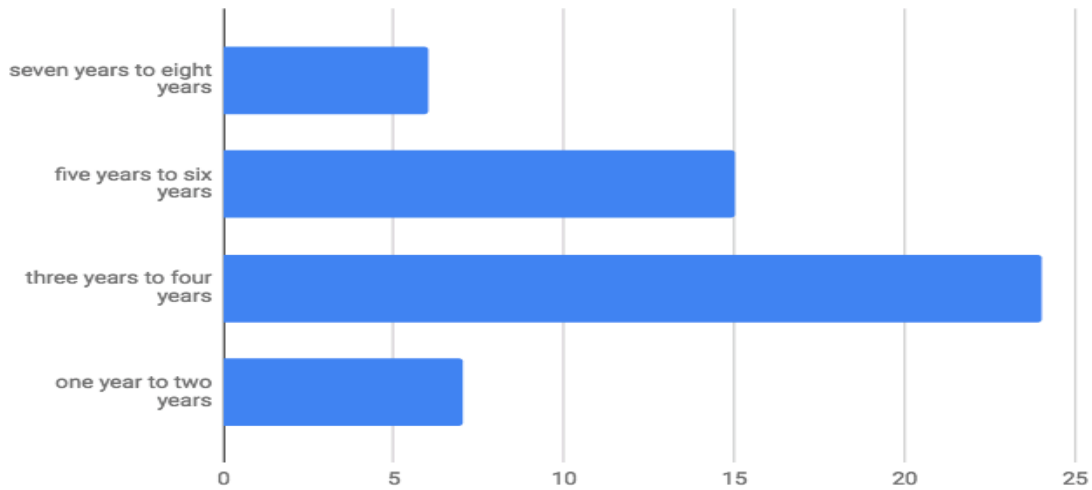


Figure 4.14: Chapter 2 (Focus: children); Question 14

Focus 15:

This figure shows how often children use mobile technology within the classroom. From the figure, you can see that 86.5% said they never used handheld technology in the classroom. This means that the majority of children did not purchase these devices to use for the class.

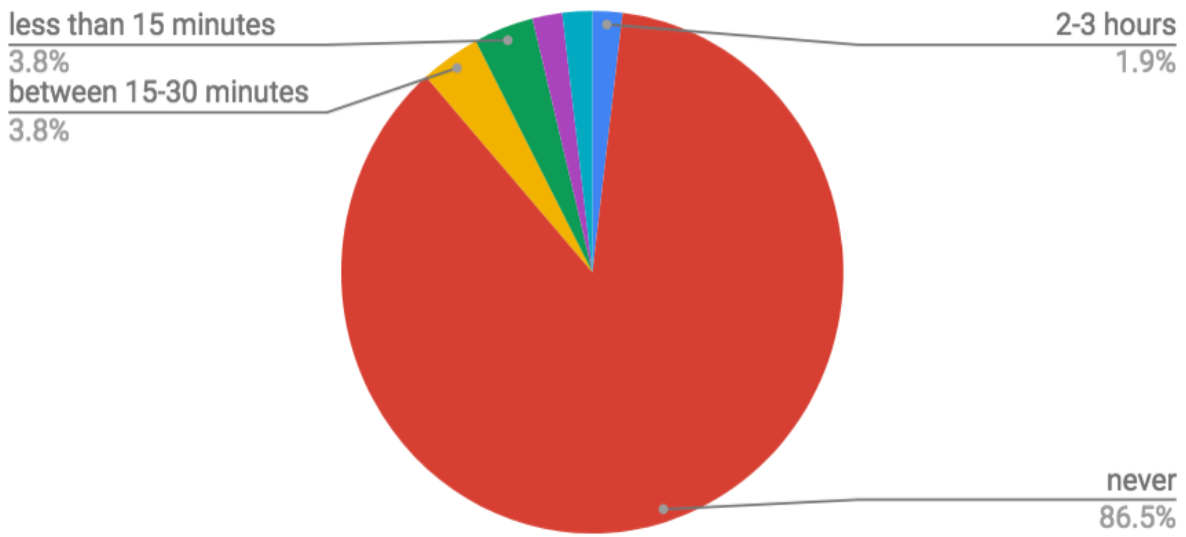


Figure 4.15: Chapter 2 (Focus: children); Question 15

Focus 16:

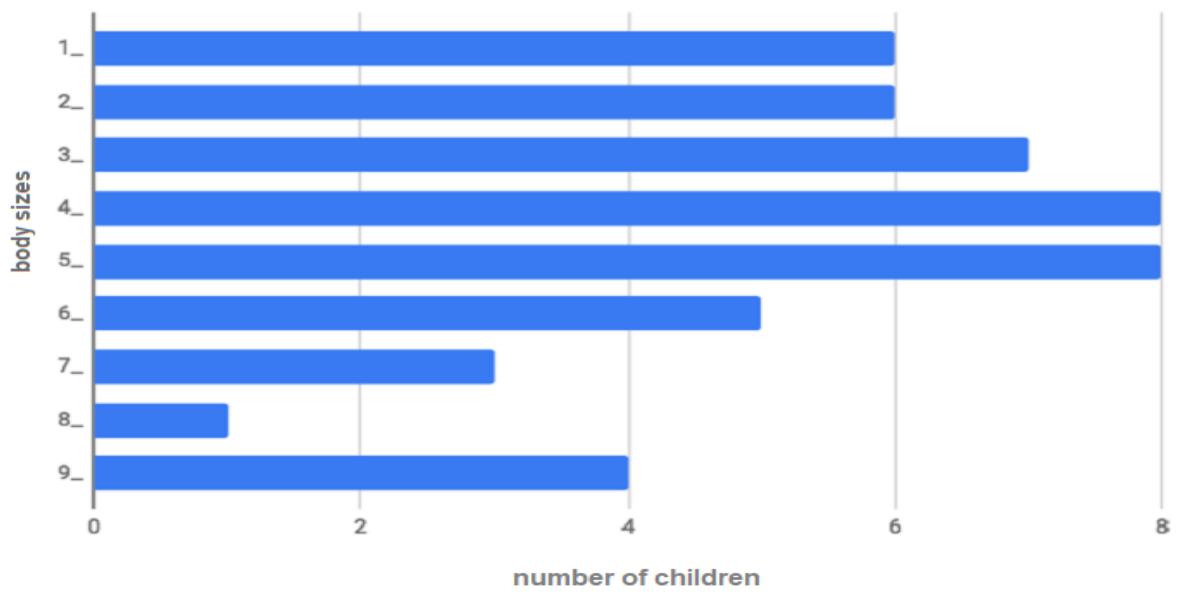


Figure 4.16: Chapter 2 (Focus: children); Question 16

Focus 17:

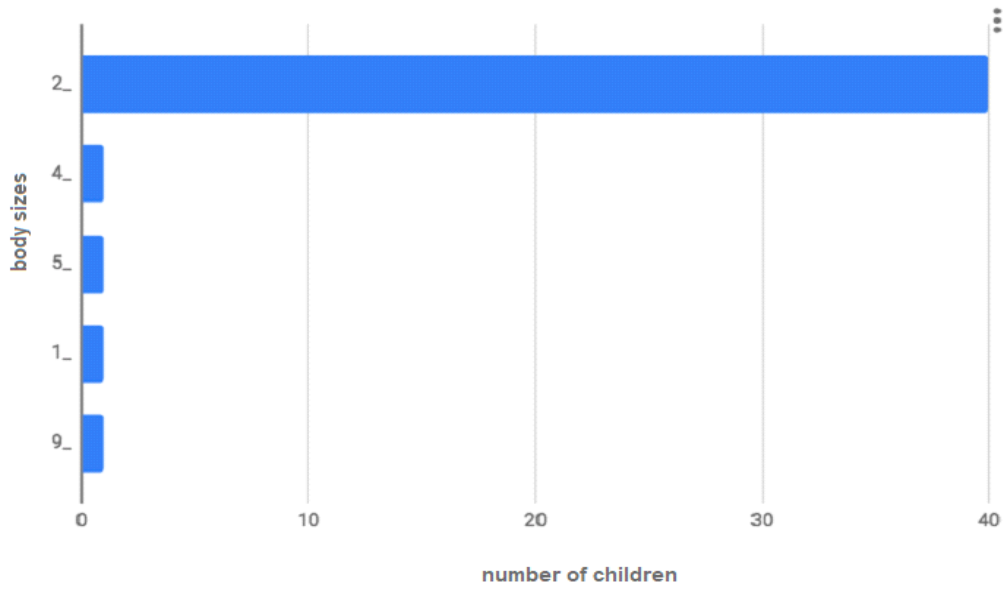


Figure 4.17: Chapter 2 (Focus: children); Question 17

Focus 18:

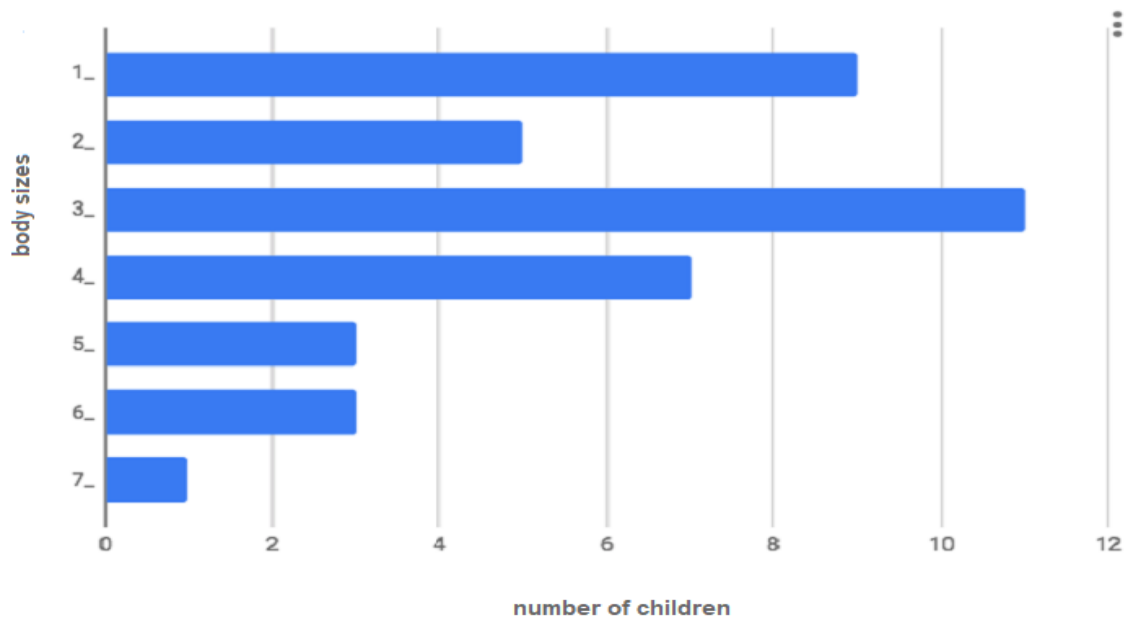


Figure 4.18: Chapter 2 (Focus: children); Question 18

All the combined results of the three figures are provided in the next figures:

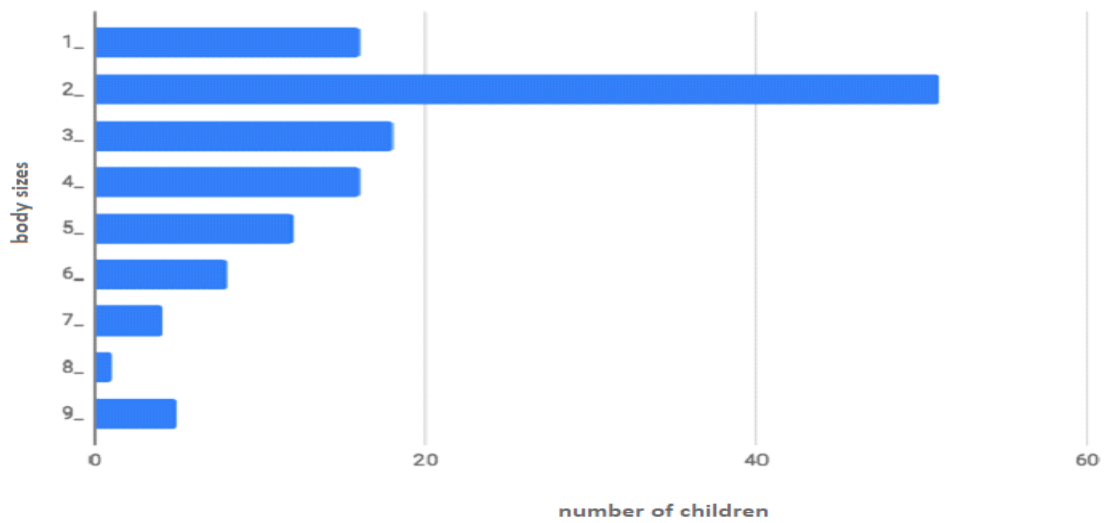


Figure 4.19: Chapter 2 (Focus: children)); Question 16-18

From the previous three graphs, it can be seen that the body size of most children were around the size designation of 2 (see Figure 4.20 for classification), meaning there were no problems with the weight of the children.

Figure 4.20: Body Size Index *has been removed due to copyright*

Focus 19:

This figure shows the extent of the children’s visits to doctors / dentists / specialist eye doctors / physical fitness specialists. Note that the majority of respondents was recommended by the devotees every six months of the year.

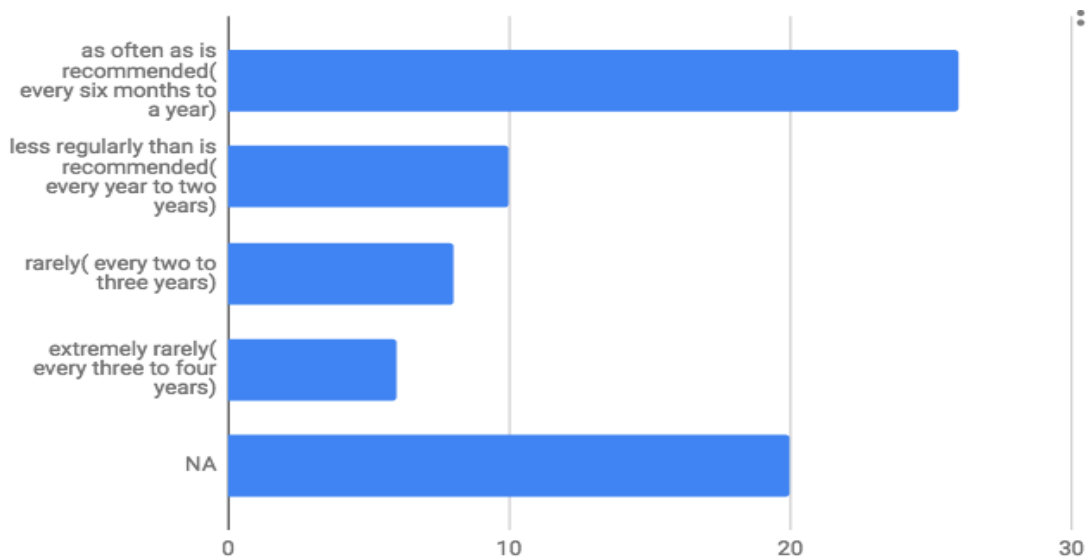


Figure 4.21: Chapter 2 (Focus: children); Question 19

Focus 20:

This graph shows how many times the children visited a psychologist / psychiatrist / mental health specialist. The graph shows that most of the respondents do not visit specialists (91.8%).

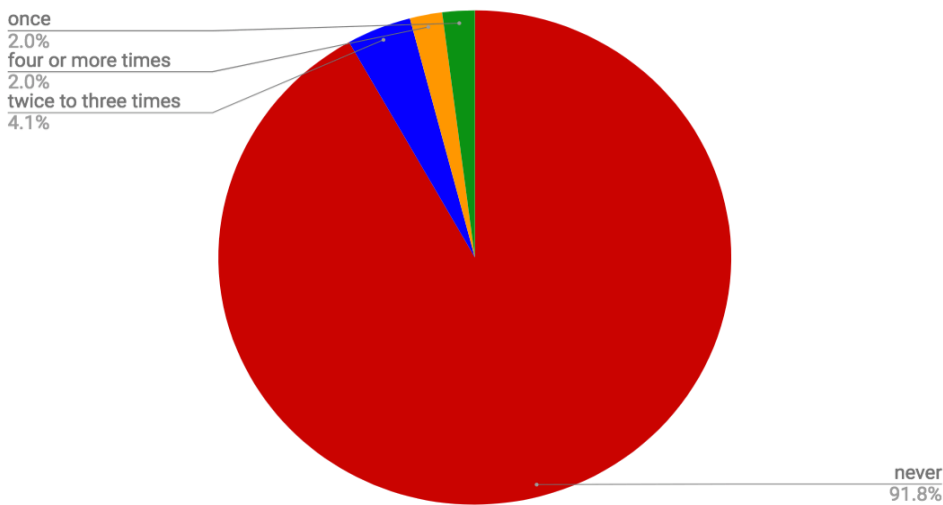


Figure 4.22: Chapter 2 (Focus: children); Question 20

4.3 Society Questions

Society 21:

This figure shows the parents opinion of mobile devices used by the children in the community. Note that the majority of parents said it has a negative impact on children as it isolates them and poses risks to their health.



Figure 4.23: Chapter 3 (Focus: society); Question 21

Society 22:

Through the answers of the parents, their opinion on devices in the community included a view that the use of these technologies was negative and caused isolation.



Figure 4.24: Chapter 3 (Focus: society); Question 22

Society 23:

This picture shows the opinion of parents of the children concerning the advancement of technology, and how it affects the children. Most of the answers were positive, including the belief that technology will progress significantly but needs to be controlled.



Figure 4.25: Chapter 3 (Focus: society); Question 23

Society 24:

This graph shows that a large number of parents strongly agree that children are at risk from strangers when said children play on mobile devices.

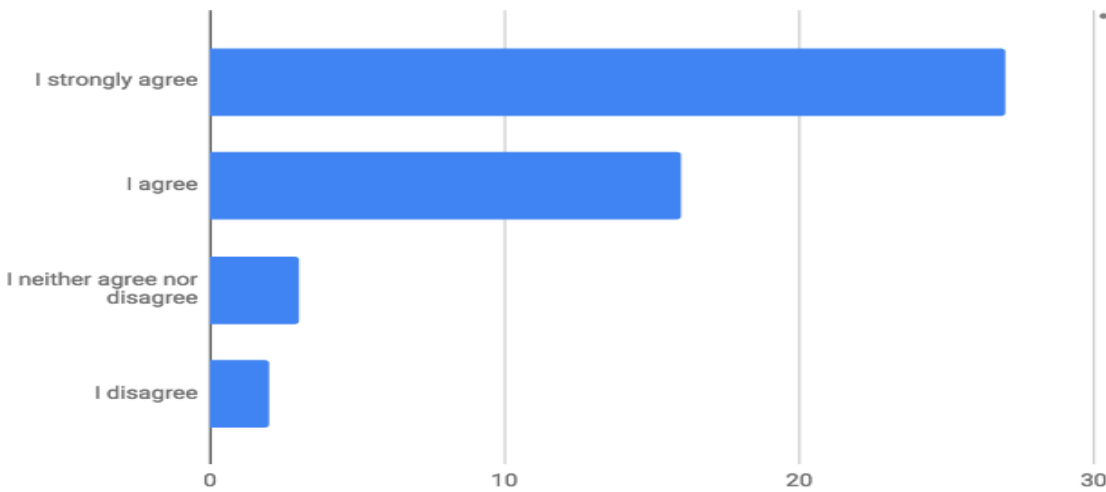


Figure 4.26: Chapter 3 (Focus: society); Question 24

Society 25:

Through this chart, it can be seen that there is a large percentage of parents who believe that there are mental and physical risks to the child when they play on technological devices.

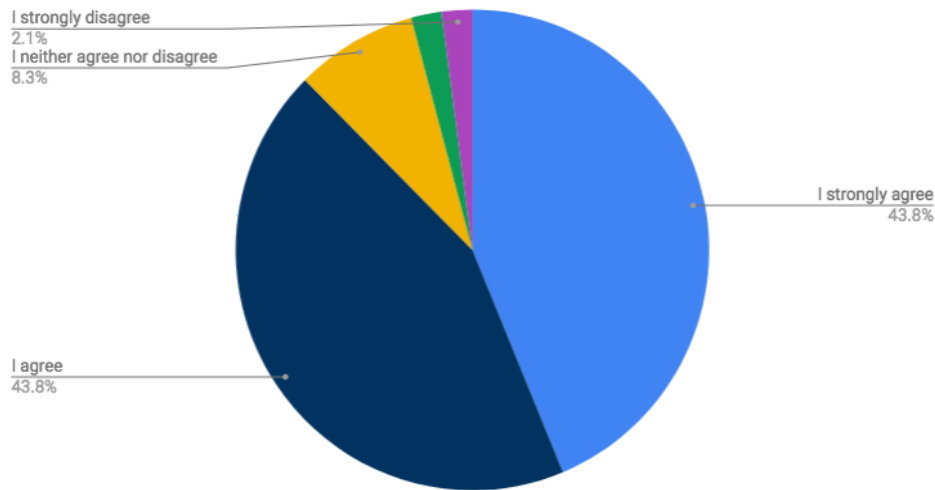


Figure 4.27: Chapter 3 (Focus: society); Question 25

Society 26:

This diagram shows that there is a negative impact on the education of the child when they use handheld devices continuously.

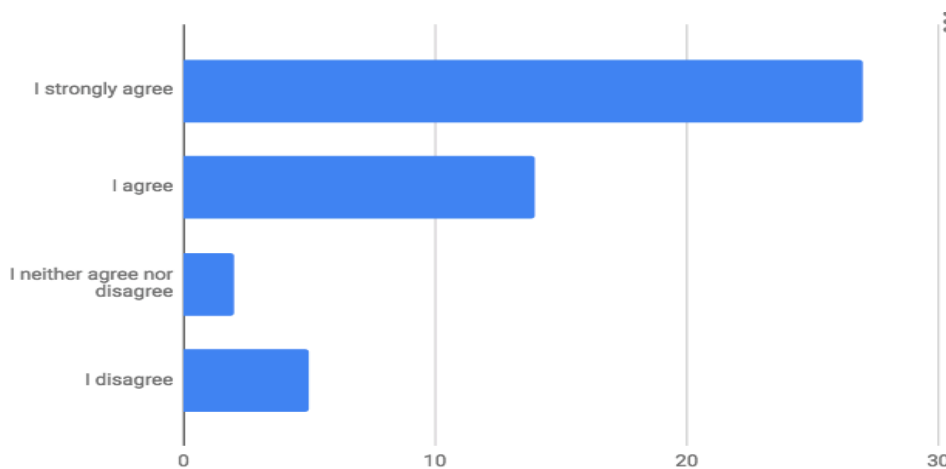


Figure 4.28: Chapter 3 (Focus: society); Question 26

Society 27:

Through this diagram, it is clear that most of the parents believe that mental or physical illness in their children was caused by the child's use of smartphones.

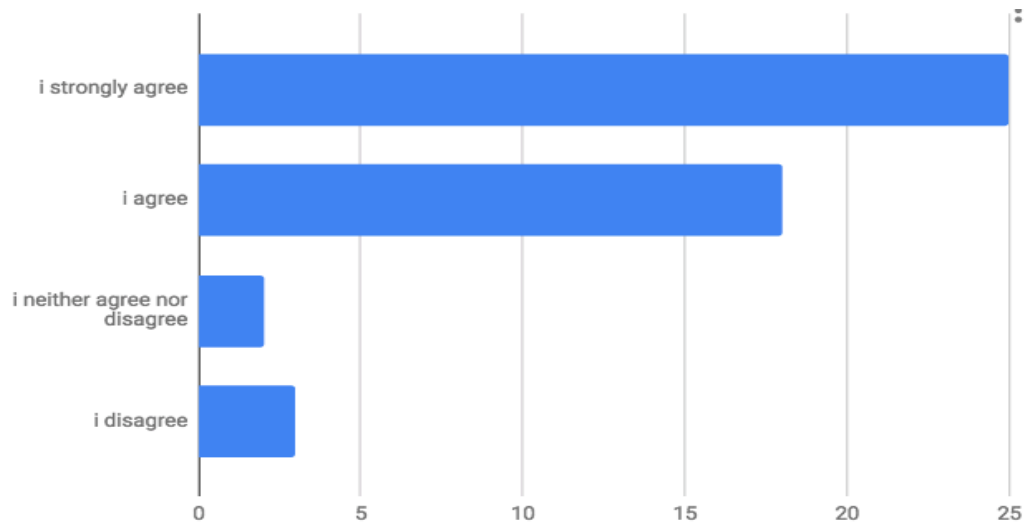


Figure 4.29: Chapter 3 (Focus: society); Question 27

Society 28:

This figure shows that the majority of parents agree that many children use smartphones to compensate for a lack of friends. Some of the parents neither agreed nor disagreed with this claim.

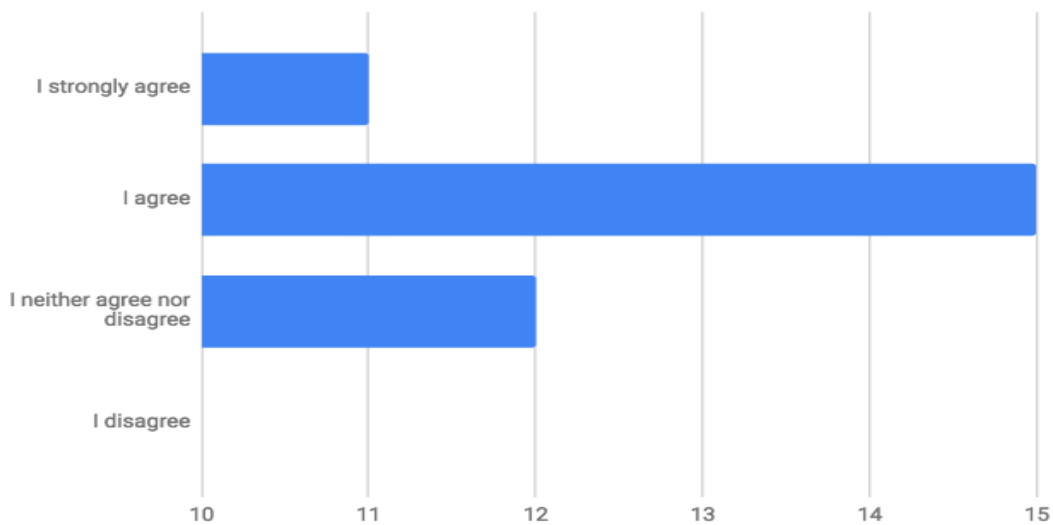


Figure 4.30: Chapter 3 (Focus: society); Question 28

Society 29:

This diagram shows that the answers were different, ranging between between “agree” and “disagree” in relation to the claim that t the use of smartphones is a sign of prosperity and a high economic position. Most of the parents who answered agreed with this statement.

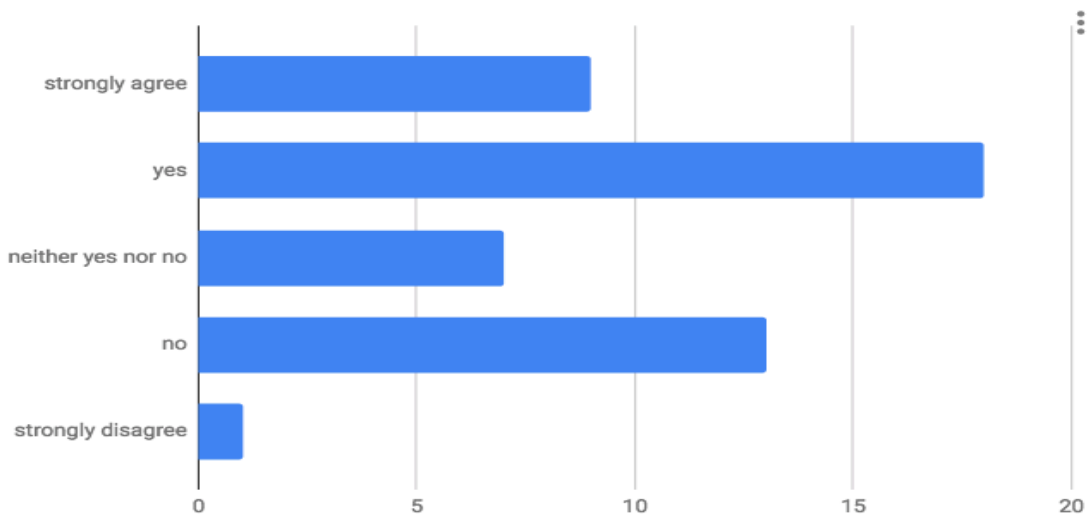


Figure 4.31: Chapter 3 (Focus: society); Question 29

Society 30:

Parents tend to be divided on what is considered an excessive use of technology vs. normal levels of use. The chart below illustrates the findings: it was found that 50% of parents believe their children use technology excessively. By combining this finding with the average number of hours spent using technology (found in *Figure 4.12*), it can be assumed 1–2 hours is the cut-off point for excessive use by children.

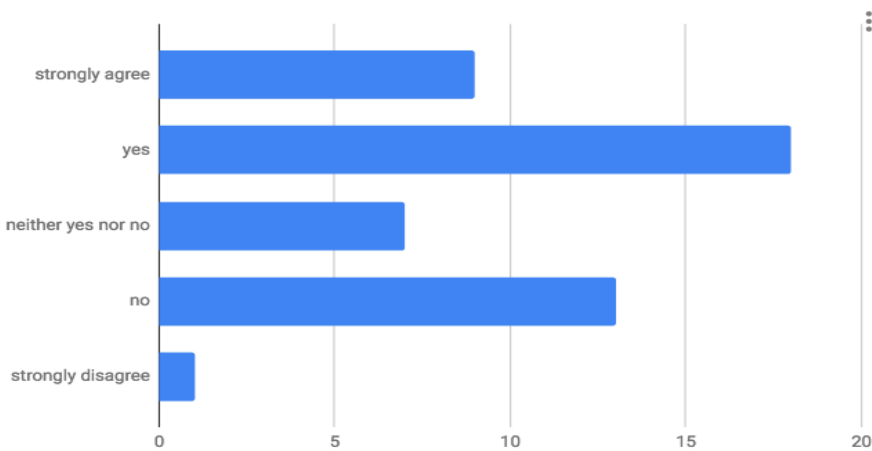


Figure 4.32: Chapter 3 (Focus: society); Question 30

Society 31:

Through this question, it was found that the time spent by children on technology, including smartphones, was between 45% and 60%.

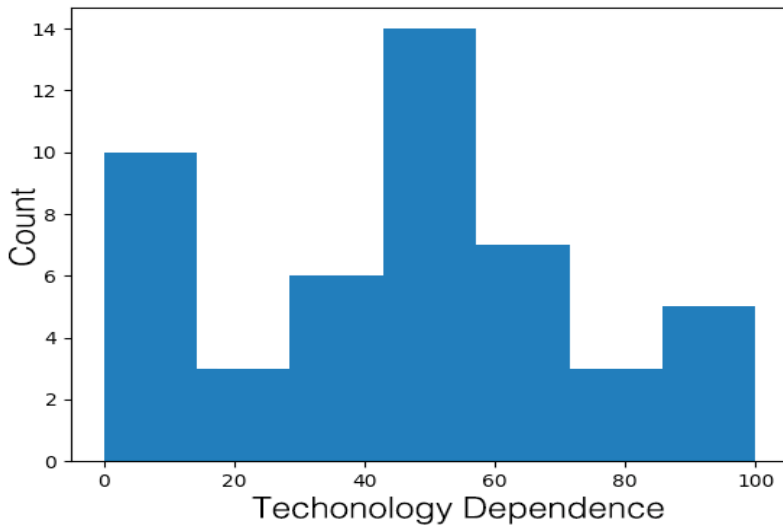


Figure 4.33: Chapter 3 (Focus: society); Question 31

Society 32:

This figure shows that most of the parents surveyed strongly believed (77.1%) that violent videogames have a negative impact on the health of the child.

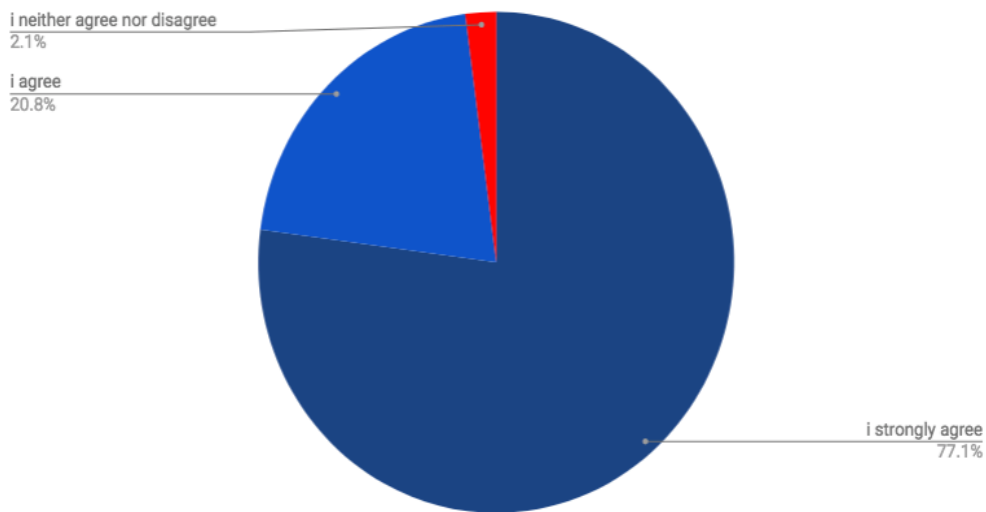


Figure 4.34: Chapter 3 (Focus: society); Question 32

Society 33:

Through this diagram, it can be seen that the social skills of children are positively influenced by technology. Most of the parents' answers were "strongly agree" and "agree". Therefore, it can be concluded that parents believe that technology can have a positive impact on the child.

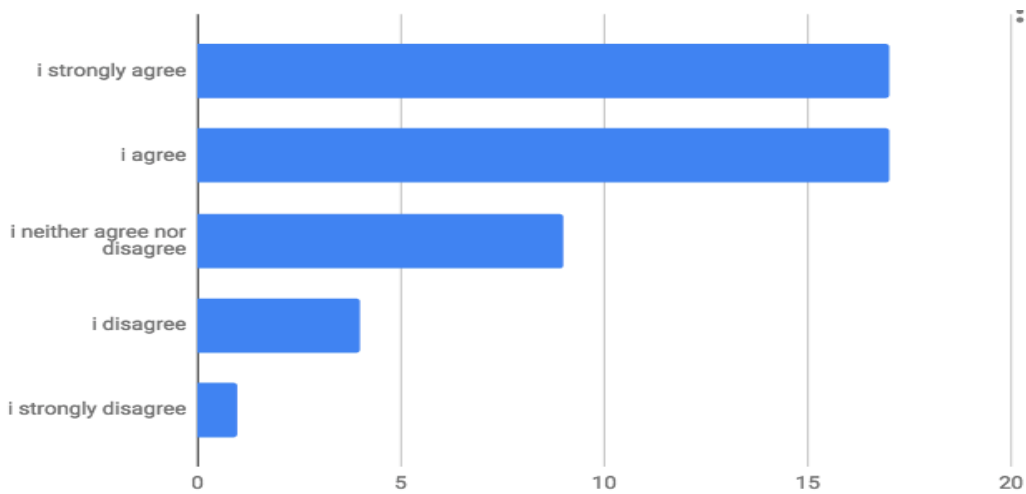


Figure 4.35: Chapter 3 (Focus: society); Question 33

Society 34:

This graph shows that most of the parents' answers were "strongly agree" and "agree" in relation to the question of whether technology has a positive impact on children's learning skills.

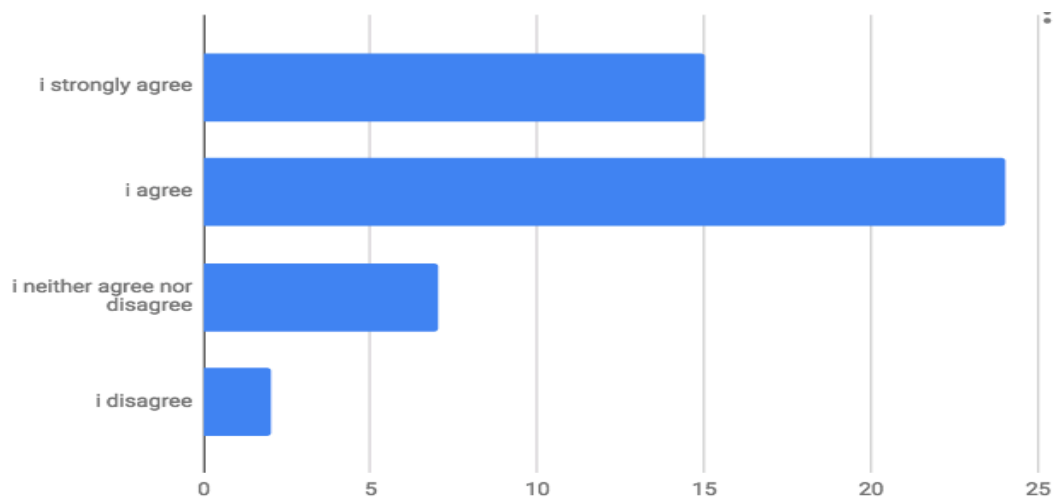


Figure 4.36: Chapter 3 (Focus: society); Question 34

Society 35:

The following graph shows that most parents agree that the children's problem-solving skills are negatively affected by technology. Most of the answers here ranged from "strongly agree" to "agree".

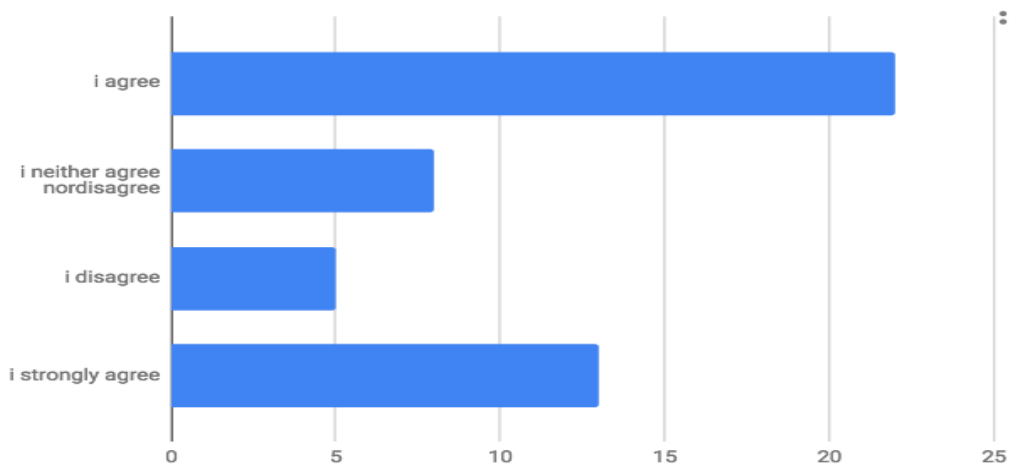


Figure 4.37: Chapter 3 (Focus: society); Question 35

4.4 Parent Questions

Parent 36:

From this diagram, it became clear that most of the children's parents used smartphone. As shown in *Figure 4.36*, a large number of respondents used smartphone, while one other listed "laptop".

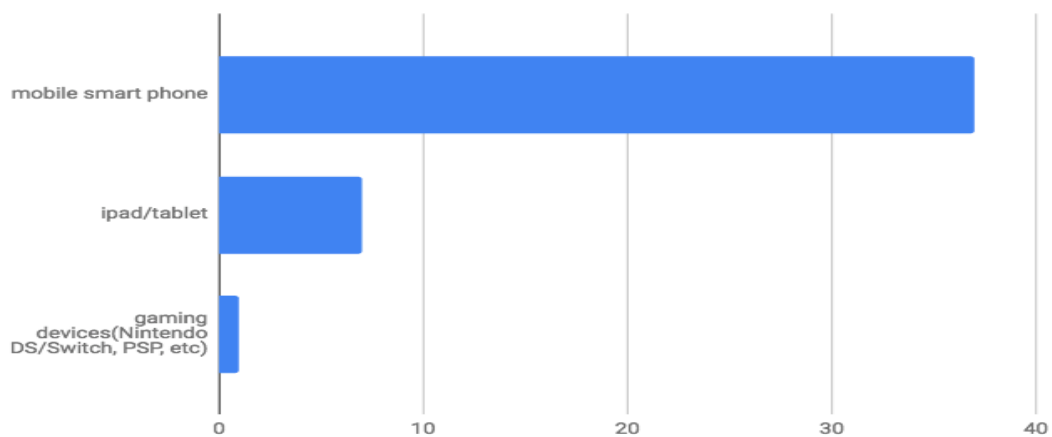


Figure 4.38: Chapter 4 (Focus: parents); Question 36

Parent 37:

This graph shows the average time spent by parents on their mobile devices for leisure. The majority of parents spent from 30 minutes to 1 hour on the devices. There was no intensive use by parents.

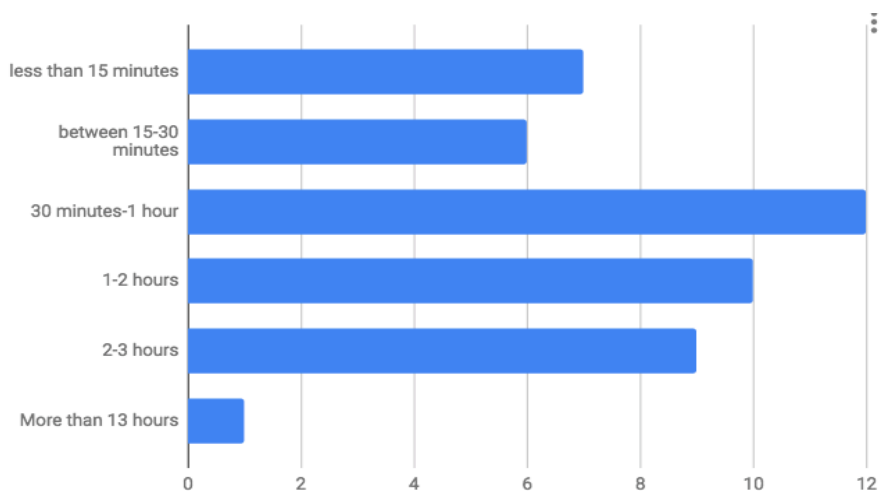


Figure 4.39: Chapter 4 (Focus: parents); Question 37

Parent 38:

The following graph shows the average time spent by parents on handheld devices. When spending time with a child, the majority of the parents spent about 1/4 of their time on handheld devices.

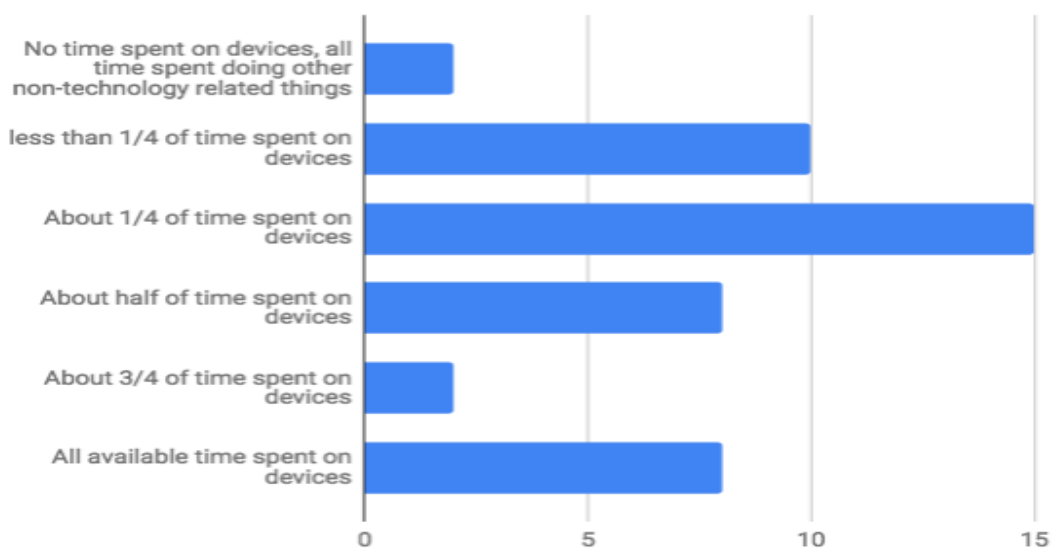


Figure 4.40: Chapter 4 (Focus: parents); Question 38

Parent 39:

As seen, the time spent by the parents on their devices during the day ranges from 1 hour to 2 hours (most parents), and then from 30 minutes to 1 hour, and then from 3 hours to 6 hours.

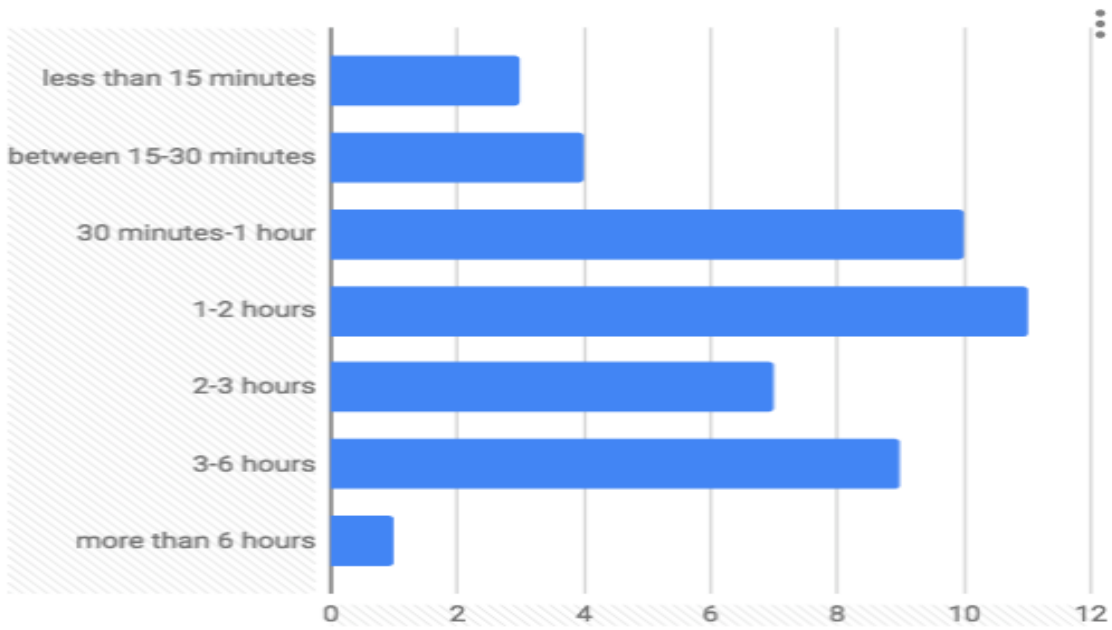


Figure 4.41: Chapter 4 (Focus: parents); Question 39

Parent 40:

As can be seen from this figure, most of the parents who responded through this study indicated that their field is a teacher.



Figure 4.42: Chapter 4 (Focus: parents); Question 40

Parent 41:

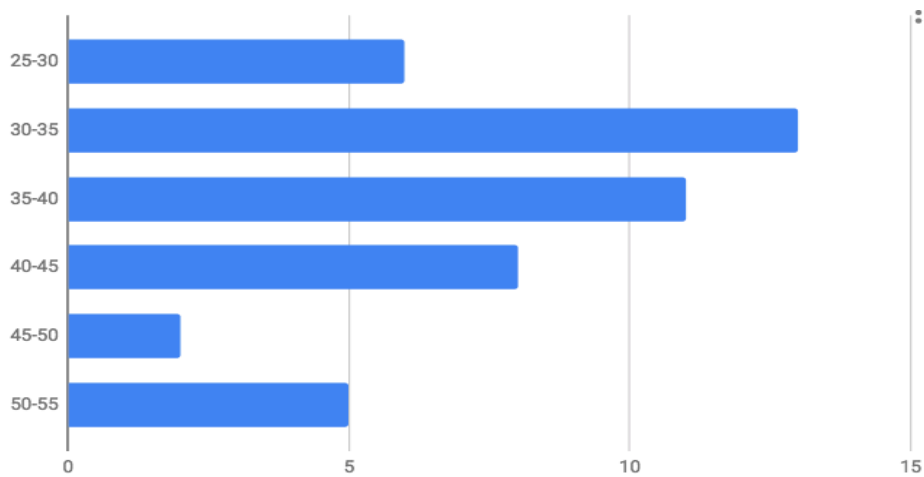


Figure 4.43: Chapter 4 (Focus: parents); Question 41

The previous figure shows that the age group of the parents is most often between 30-35 and then 35-40.

Parent 42:

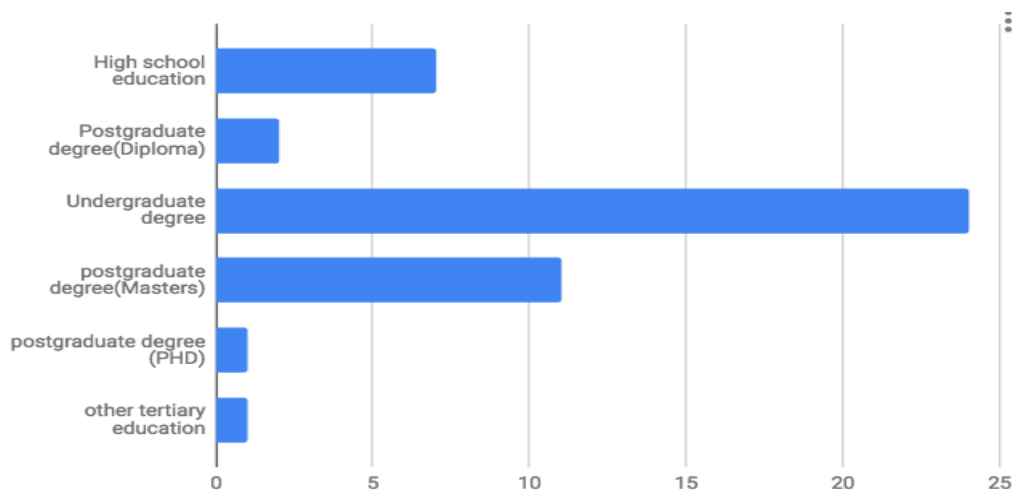


Figure 4.44: Chapter 4 (Focus: parents); Question 42

From this figure, it is clear that the highest level of education achieved by parents is a bachelor's degree.

4.5 Conclusion

Designing high-quality questions was a challenging task. The high level of analysis and graph visualization for every question allows for a better understanding of the respondent's and their children's demographic information. We also learned more habitual facts relating to the technology consumption of the parents and children, as well as their perceptions of technology and the positive and negative opinions of technology among the parents. The paper provided some explanations to all questions relevant to the research theme. The next chapter will organise the data and perform statistical tests to examine the previously stated hypotheses.

5. HYPOTHESES TESTING AND ANSWERING RESEARCH QUESTIONS

5.1 Introduction

This chapter will lay out the research questions and hypotheses. With the statistical testing that is based on the the survey's responses, we can find relations among variables and test our hypotheses to see if they hold true (rejecting the null hypothesis) or whether there is no suggestable evidence to make the hypothesis hold. This study has three questions listed as follows:

Q1: What is the level of awareness and use of parental control over children's handheld devices?

Q2: What is the effect of the time spent on handheld devices on a child's academic level?

Q3: Does the use of handheld devices have a negative or positive impact on a child's health?

We answered the first questions by simple analysis. The second and third questions were reconsidered as hypotheses that would require statistical testing.

5.2 Analysis

Q1: What is the level of awareness and use of parental control over children's handheld devices?

The study found that among the 71 families surveyed, 6 respondents (~9%) gave their children total freedom in viewing content and downloading apps. Interestingly, those who allowed total freedom imposed restrictions in relation to timing/physical checking/passwords without making their children aware of these restrictions. One respondent placed no restriction on time or content.

The other 91% of parents answered this question indicating that they used some sort of restriction on content (as demonstrated in Figure 5.1). The other restriction is timing, as explained in Figure 5.2, and we can confidently state that 41% of respondents perform daily checks over their children's browsing history. 32% do this at least once a week, and 9% do this once a month, and the rest (i.e. 17% of parent) are rarely or never Table 1 shows that the percentage of the respondent's answers. Some respondents voluntarily highlighted some parental control that they used as represented in the word cloud in the following Figure 5.3.

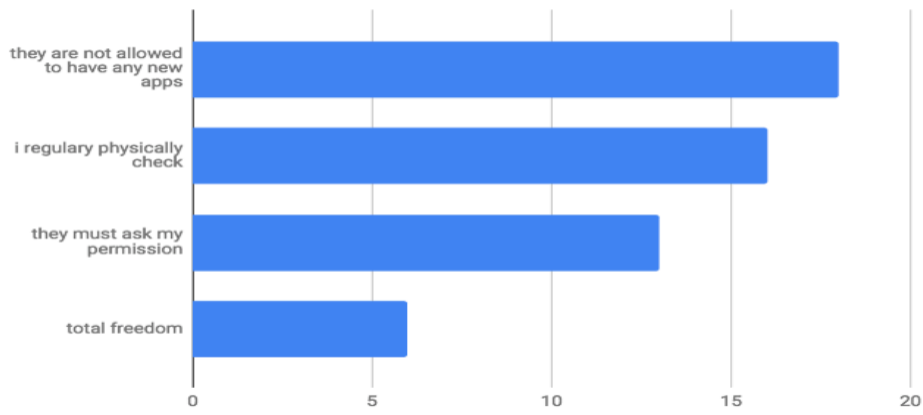


Figure 5.1: Chapter 2 (Focus: children): Question 11

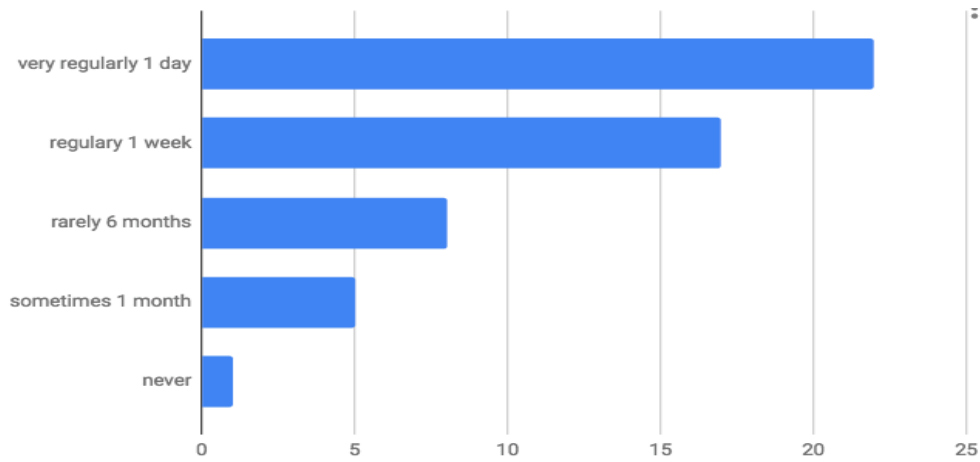


Figure 5.2: Chapter 2 (Focus: children); Question 8



Figure 5.3: Chapter 2 (Focus: children); Question 10

We also did not find any relation between the level of control in relation to time or content restriction when combined with parental age or education level.

focus8

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	very regularly 1 day	22	31.0	41.5	41.5
	regularly 1 week	17	23.9	32.1	73.6
	sometimes 1 month	5	7.0	9.4	83.0
	rarely 6 months	8	11.3	15.1	98.1
	never	1	1.4	1.9	100.0
	Total	53	74.6	100.0	
Missing	System	18	25.4		
Total		71	100.0		

Table 5.1: Frequency (focus 8)

The following analysis was performed using Chi-square tests in SPSS. The aim was to test the hypothesis that there is no significant association between the items (questions) of the questionnaire, as stated. Nine Chi-square tests were performed, as described below. In all cases the null and alternative hypothesis was used. The decision criteria were that if the p-value is less than 0.05, we reject the null hypothesis and conclude that there is a significant association between the items. The significance level was 95% in all the nine tests.

Q2: What is the effect of the time spent on handheld devices on a child’s academic level?

We first need to test the relations among the answers to this question; we perform this by using chi-square.

Hypothesis Testing

H1: there is no significant association between respondents’ beliefs on the effect of continuous use of smartphones and how long their children stayed on handheld devices.

H2: there is no significant association between respondents’ beliefs on the effect of continuous use of smartphones and how old their children were when they started using handheld devices.

H3: there is no significant association between respondents’ beliefs on the effect of continuous use of smartphones and if their children do use handheld technology often within the classroom.

Items		χ^2 value	P-value	Remark
The continued use of smartphones negatively affects the educational level of children. Do you agree or disagree?	How much time per day would you say your children spend on handheld devices?	13.02	.601	Not Significant
	How old were your children when they started using handheld devices?	9.288	.411	Not Significant
	How often do your children use handheld technology within the classroom?	11.888	.687	Not Significant

Table 5.2: Summary of Chi Square test for Research Question 2

There was no significant association ($p > .05$) between respondents' beliefs on the effect of continuous use of smartphones and how long their children stayed on handheld devices. This implies based on the observations considered in this study, parents who place restrictions on their children's use of handheld devices do not think that handheld devices have an impact on the child's academic level.

It was also found out that the age at which children were when they started using handheld devices has no significant ($p > .05$) association with respondents' beliefs on the negative effects of continual use of smartphones on educational level of children, therefore the length of time a child has been using handheld device does not affect the parent's opinion about the impact of handheld devices on children's academic levels.

Finally, the frequent use of handheld technology by children wasn't found to be significantly ($p > .05$) associated with respondents' beliefs on the negative effects of continual use of smartphones on educational level of children, this implies that the extent that the children use handheld devices in class does not impinge on the parent's perception of the device's impact on the child's academic levels

Answer to Research Question 2

Based on the observations considered in this study as well as the report of the inferential test, it was shown that the time spent on handheld devices has no significant effects (be it negative or positive) on a child's academic level.

Q3: Does the use of handheld devices have a negative or positive impact on a child's health?

Hypothesis Testing

H4: there is no significant association between how long children stayed on handheld devices and presence of any major physical differences/problems with the child as a result of their gaming/socialising habits

H5: there is no significant association between how long children stayed on handheld devices and classification of the oldest child according to body sizes.

H6: there is no significant association between how long children stayed on handheld devices and classification of the second oldest child according to body sizes.

H7: there is no significant association between how long children stayed on handheld devices and classification of the third oldest child according to body sizes.

H8: there is no significant association between how long children stayed on handheld devices and responses to the opinion that children are at risk of mentally/physically detrimentally damaging factors when they play on these devices.

H9: there is a significant association between how long children stayed on handheld devices and responses to the opinion that mental/physical illness and isolation may result from the use of smart phones from children.

	Items	χ^2 value	P-value	Remark
How much time per day would you say your children spend on handheld devices?	Have you seen any major physical differences/problems with your child as a result of their gaming/socialising habits?	14.345	.813	Not Significant
	If you had to classify your oldest child as one of these body sizes, which would you select?	42.797	.352	Not Significant
	If applicable, if you had to classify your second oldest child as one of these body sizes, which would you select?	40.112	.465	Not Significant
	If applicable, if you had to classify your third oldest child as one of these body sizes, which would you select?	36.874	.382	Not Significant
	Children are at risk of mentally/physically detrimentally damaging factors when they play on these devices. Do you agree or disagree?	18.587	.549	Not Significant
	Mental/physical illness and isolation may result from the use of smart phones from children. Do you agree or disagree?	26.431	.034	Significant

Table 5.3: Summary of Chi-square test for Research Question 3

There was no significant ($p > .05$) association between how long children stayed on handheld devices and presence of any major physical differences/problems with the child as a result of their gaming/socialising habits as reported by chi-square statistics. It is believed that there are several other significant factors that

affects physical differences/problems in a child other than their time spent on handheld devices and also that having a record of association between these variables does not implies one causes the other as correlation does not imply causation.

For the classification of body sizes of first, second, and third oldest child by respondents, there was no significant association ($p > .05$ in each cases) between these classifications and how long the children stayed on handheld devices. We therefore conclude that the time per day that first, second, and third oldest children spend on handheld devices has no relationship with their obesity levels.

Having a reported non-significant statistic ($p > .05$) for the association between how long children stayed on handheld devices and respondents' responses to the opinion that children are at risk of mentally/physically detrimentally damaging factors when they play on these devices further proves the validity of reports from psychologist that the use of these devices actually helps to mentally trained the children to be more logical in thinking which do result into sound-minded children.

Finally, a significant association ($p < .05$) was found between how long children stayed on handheld devices and responses to the opinion that mental/physical illness and isolation may result from the use of smart phones from children. This can be due to the fact that the longer children stayed on handheld devices, the lesser the time they have relate socially with physical interaction thereby resulting into isolation.

Answer to Research Question 3

Although majority of further sub-questions being asked in the form of hypotheses was rejected, we however have a significant association ($p < .05$) reported for how long children stayed on handheld devices and responses to the opinion that mental/physical illness and isolation may result from the use of smart phones from children. We thereby conclude that the use of handheld devices has a negative impact on a child's health but only with its tendency to cause isolation.

Testing Q2: What is the effect of the time spent on handheld devices to a child's academic level?

This study then investigated whether children's time spent on handheld devices would have a positive or negative impact on their academic level. After converting responses to ordinal values, school attainment (grade) (Answers of: Q2), and other variables (Answers of: Q6, Q12, Q14, Q15, Q26) have been statistically tested by Spearman's Rank-Order Correlation.

•Results shows that all are independent except for the last result:

Spearson test	rho	p-value < (alpha = 0.05)	comment
Q2,Q12	0.018	0.881 “.”	No relation
Q2,Q14	0.102	0.412 “.”	No relation
Q2,Q15	0.062	0.617 “.”	No relation
Q2,Q26	-0.4588	0.000257 “**”	Significant relation: negative correlation

“.”: Insignificant: variables are independents from one another

“**” significant results. either high positive or high negative correlation

Table 5.4: Rank-order Correlation

- Results suggest that a long time spent using technology has neither positive nor negative relation with other variables except for Q2.
- The table shows that there is a negative correlation between parents (negative conception about technology Q26) and children study attainment (Q2).
- Parent who are aware of the consequences of technology guide the use of technology, even with long hours spent on educational materials and entertainment which can positively reflect on children’s grades.

The next experiment tests if grades can be affected by hours spent using technology.

- We split data based on hours spent on technology (Q12) into two groups: (1) low spent hours (2) high hours spent:

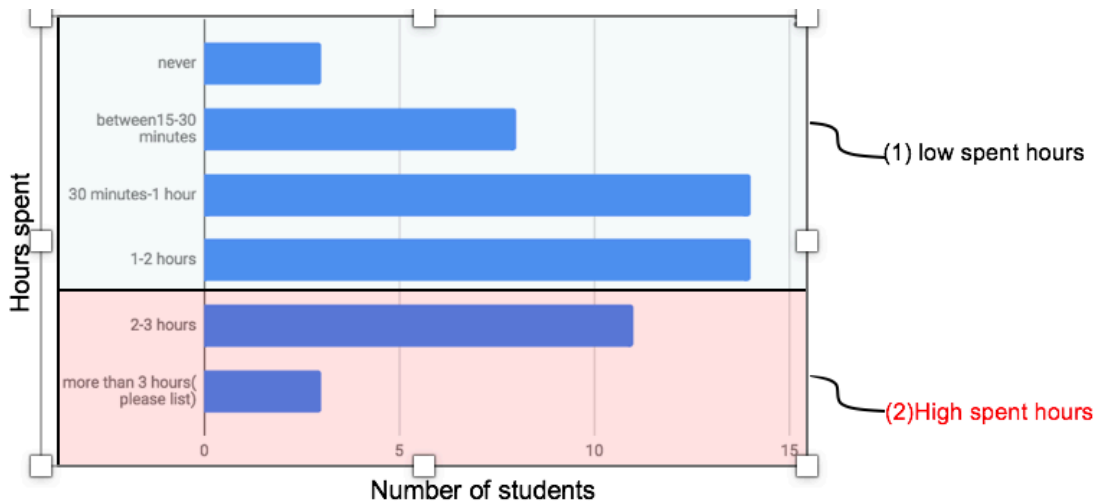


Figure 5.4: Number of students distribution over number of Hours Spent on Technology.

•After conducting t-test one-tail (alpha = 0.05), we obtained the following results

	Group 1: low spent hours	Group 2: high spent hours
Observation	11	48
mean	7.67	9.36
standard deviation	2.88	1.21
Statistical Test	Degree of freedom=57 $t= 1.91$ $(T \leq t)=0.031$ <0.05**	

Table 5.5: T-Test

- The results, shown in the previous table, show that the group of high spent hours on technology has a slightly higher study attainment average (1.5+ grade increase) with statistical significance.
- These results indicate that the regular use of technology, from between 1 and 4 hours, may have no harm on children as long as parental control is implemented and apps are used that coincide with the children’s school curriculum.

5.3 Conclusion

As already mentioned in this chapter, the main questions have been answered analytically and two hypotheses were tested. Parents tend to use parental control in the form of controlling the amount of time spent on the device, or controlling the content that the children are exposed to. Interestingly, long hours spent on technological devices statistically shows no effects, despite there being slightly increased in grades as the number of hours is increasing. This grade increase is yet not statistically significant; hence the null hypothesis still holds in which hours spent on technology has neither positive nor negative effects on children. On the other hand, we found that long spent hours on technology is significant as it may cause health issues.

6. PROPOSING STRATEGIES REGULATING TECHNOLOGY USE FOR CHILDREN

Conducting an online survey to obtain insight into various variables, finding relations, and testing hypotheses serve one aspect of this study's objectives. The other side is to provide recommendations driven by our findings that are presented in the previous chapters, namely chapter 4 and 5. By providing recommendations based on the survey findings the hope is to (1) mitigate health side effects and academic underachievement that are potentially associated with excessive time spent on devices and to (2) demonstrate levels of parental control that have positive effects on children when the objective is to allow for a healthy exposure that can benefit them in their school work and their personal progress.

6.1 Defining Policies based on Coarse Rules:

There are many conditions that determine the recommendations for a family in terms of the proper use of technology (i.e. time, contents and both). Technology by itself can be a useful tool for helping a child's education and learning (Cristia et al. 2012; Hatch 2012). Technology provides the child with vast knowledge and information at the tip of their finger. However, it comes with a financial burden on families needing to provide electronics and apps and being obligated to pay internet connection expenses. Parents aim to provide technology to make their children happier, so they could learn from technology, but such accommodations can result in negative outcomes ranging from: academic under achievement, distorted personal developments, further isolated individuals who live in their virtual realm and solitary life, and who lack proper exposure of real life lessons which lead to other linked health issues.

Looking into the study data, we have age, body shape (see figure 6.1), and number of hours spent. We can look for this 3 dimensional space combining three variables: first two are discrete ordinal values (i.e. age and hours spent), and third variable is categorical value (i.e. parents use control as Yes or No). Table 6.1 shows all details and the values.

Figure 6.1: Body Size Index *has been removed due to copyright restrictions.*

Variable	Type	Range
Age groups	Ordinal	(2 to 3),(4 to 5) ,(6 to 7) ,(8 to 9) ,(10 to 11) ,(12 to 13) and (13+).
Hours Spent	Ordinal	Never, between 15-30 minutes, 30 minutes to 1 hour, 1-2 hours and 2-3 hours.
Parent Control	Categorical (Yes/No)	Yes and No
Body Size	Ordinal	1,2,3,4,5,6,7,8 and 9.

Table 6.1: Variables used as parameters for linking policy recommendation elements

To map right policy to given parameters we reiterate the findings derived from previous chapters, then we follow up with coarse rules based on observations and hypothesis

- (1) Given our findings, hours spent seem to have no statistical significance in low level academic achievements.
- (2) High hours spent has a strong relation with health issues such as obesity and parent's negative perceptions of causing problems.
- (3) The more content control on devices the better academic achievements.

We define the coarse rules by defining number ranges deduced by examining distributions of the survey responses and then proper values are selected. Recommendations were divided into five distinct ranges bases on the data survey patterns, such that we can recommend tips based on matching the combination of attributes (i.e. age, hour spend on technology and body size). The proper tips can automatically conclude if any row is applicable (if a rule has an attribute left empty, that means any value of that attributes is accepted as a match), and all defined rules are designed to be mutually exclusive.

We define the coarse rules as follows:

RULES				
ID	Age	Hours	Body Size	Tips
1	If the age of the children < 1	–	–	Parents are advised not to give their children technology at this age
2	1 – 2 2 – 3	< 15 minutes or 15– 30 minutes	1 – 4	Parents should check their child's device very regularly e.g. once a day. It is advisable to visit the doctor regularly (every six months to year).
3	3 - 4 4 - 5 5 - 6	30 mins – 1 hr or 1-2 hours	5 - 7	Not giving children complete freedom on technology. Use parental controls on children's devices. Parents should check their child's device very regularly. Use application that help movement and activity to reduce obesity.

RULES				
ID	Age	Hours	Body Size	Tips
4	6 - 7 7 - 8	2 – 3 hours or 3+ hours	8-9	Use parental controls on children’s devices. Children are not allowed access to any application or games except that allowed by parents. Use application that encourage movement and activity. Visit the doctor continuously.
5	Others			Use parental control on children’s devices. Parents should check their children’s devices very regularly. Not giving them devices for a long period

Table 6.2: Coarse Rules

6.2 Conclusion

We attempted to identify coarse rules and tips according to a schematic of the three inputs: age, hours spent, and body size index. These rules are intended to promote effective technology use to enhance education objectives and to avoid the misuse of technology. Thus, this study presents some recommendations that educational institutes and parents may use to ensure the effective use of technology. Moreover, these rules can be provided to parents so that they can easily obtain appropriate recommendations based on their inputs.

7. THESIS CONCLUSION AND DISCUSSION

All technologies aim to make human life more convenient and to allow more practical solutions for our needs. These technologies have become an increasingly indispensable aspect of family members' daily activities for a variety of purposes, ranging from entertainment, education, communication, and even as a "luxury" tool that can later become an "addictive" tool where family members can no longer abandon technology. The pros and cons of technology and its impact on children has received much attention. The pros and cons have become more puzzling due to inconsistent outcomes that were presented in the literature. Because of this, we first designed a survey that targeted families with questions separated into categories: general, focus, society, and parent to examine the study's main hypotheses. We proposed three areas of research, concerning (1) parental control over children's technology use; (2) academic attainment with technology; and (3) the health-related issues of technology consumption on children. We collected 71 responses from families comprising 111 children in total. We found the majority of parent's place restrictions on the technology consumption of their children; their restriction includes limiting the time spent using it and restricting the content that their children can view on it. From the side of weak educational attainment concerns or other potential health impacts on children, we conducted statistical tests attempting to examine the following hypotheses: (1) *What is the effect of the time spent on handheld devices to a child's academic level?* (2) *Does the use of handheld devices have a negative or positive impact on a child's health?* We examined the respondent's answers and employed both Chi-square and t-test to reveal significant indications in relation to the hypotheses. Our finding is that the more parents are aware of technology and the more they guide and restrict content on the handheld devices, the better a child's academic achievement. On the topic of potential health concerns, we found that the greater the hours spent on handheld devices by children, the more negative perception parents had of technology's impact on children. We also created a system of recommendation that lays out some tips for parents, based on the given information.

This study has some limitations. First, it was not possible to obtain a sufficient number of children aged 8 years and less. Second, we could not obtain a comprehensive view of various devices since most of the gaming devices are not prevalent as opposed to some tablets, iPads and smartphones. We could not determine which devices are being used the most or the least by children. We intended to have a larger number of respondents for more accurate findings, but we only received 71 responses from parents with 111 children in all.

BIBLIOGRAPHY

Alfaez, R 2017, *Tablet Use for Young Children*, viewed 2 March 2018, <<https://www.surveymonkey.com/r/WJTVJVC>>.

Alshahrani, H 2016, 'A brief history of the Internet in Saudi Arabia', *TechTrends*, 15 January, vol. 60, no. 1, pp. 19-20.

American Academy of Child and Adolescent Psychiatry 2011, *Children and video games: playing with violence*, viewed 23 August 2017, <http://www.aacap.org/aacap/families_and_youth/facts_for_families/Facts_for_Families_Pages/Children_and_Video_Games_Playing_with_Violence_91.aspx>.

Angry Birds 2017, *Angry birds*, viewed 12 October 2017, <<https://www.angrybirds.com>>.

Anxiety Disorders Association of America 2016, *Anxiety disorders in children*, viewed 23 October 2017, <<https://adaa.org/sites/default/files/Anxiety%20Disorders%20in%20Children.pdf>>.

Apple 2017, *App Store review guidelines*, viewed 26 October 2017, <<https://developer.apple.com/app-store/review/guidelines/>>.

Apple 2017, *Family privacy disclosure for children*, viewed 26 October 2017, <<https://www.apple.com/legal/privacy/ae/parent-disclosure/>>.

Apple 2017, *Parental gates*, viewed 26 October 2017, <<https://developer.apple.com/app-store/parental-gates/>>.

Apple 2017, *Use Night Shift on your iPhone, iPad, and iPod touch*, viewed 26 August 2017, <<https://support.apple.com/en-us/HT207570>>.

Australian Classification Board 2015, *Classification categories explained: classification for films and computer games*, viewed 19 October 2017, <<http://www.classification.gov.au/Guidelines/Pages/Guidelines.aspx>>.

Australian Government 2017, *Legislation*, viewed 2 November 2017, <<https://www.esafety.gov.au/about-the-office/legislation>>.

Barron, C 2015, *How technical devices influence children's brains*, viewed 10 August 2017, <<https://www.psychologytoday.com/blog/the-creativity-cure/201505/how-technical-devices-influence-childrens-brains>>.

Belikova, I 2017, *Toddler educational learning games. Kids apps free by Irina Belikova view more by this developer*, viewed 23 October 2017, <<https://itunes.apple.com/us/app/toddler-educational-learning-games-kids-apps-free/id1195757489?mt=8>>.

Brandt, C, Lock, C & Grise, C 2017, *The best educational apps for kids*, viewed 23 October 2017, <<http://www.parents.com/fun/entertainment/gadgets/best-educational-apps-for-kids/>>.

- Brito, R, Francisco, R, Dias, P & Chaudron, S 2017, 'Family dynamics in digital homes: the role played by parental mediation in young children's digital practices around 14 European Countries', *Contemporary Family Therapy*, 13 September, vol. 39, no. 4, pp. 271-280.
- Bulger, M, Burton, P, O'Neill, B & Staksrud, E 2017, 'Where policy and practice collide: Comparing United States, South African and European Union approaches to protecting children online', *New Media & Society*, 16 January, vol. 19, no. 5, pp. 750-764.
- Candy Crush 2017, *Candy Crush*, viewed 12 October 2017, <<http://candycrushsaga.com/en/>>.
- Chahal, H, Fung, C, Kuhle, S & Veugelers, P 2013, 'Availability and night-time use of electronic entertainment and communication devices are associated with short sleep duration and obesity among Canadian children', *Pediatric Obesity*, February, vol. 8, no. 1, pp. 42-51.
- Child Internet Safety 2017, *Child Internet Safety*, viewed 9 October 2017, <<http://www.childinternetsafety.co.uk>>.
- Crisp, S 2017, *How to use parental controls on the Nintendo Switch*, viewed 30 October 2017, <<https://newatlas.com/how-use-nintendo-switch-parental-controls/48396/>>.
- Cristia, J et al. 2012, *Technology and child development: evidence from the One Laptop per Child Program*, viewed 7 September 2017, <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2032444>.
- Daud, M & Jaul, J 2017, 'Protecting children against exposure to content risks online in Malaysia: lessons from Australia', *Malaysian Journal of Communication*, vol. 33, no. 1, pp. 115-126.
- Disney 2017, *Club Penguin Island*, viewed 26 October 2017, <<https://www.clubpenguinisland.com>>.
- Disney 2017, *Club Penguin Island: Parents*, viewed 26 October 2017, <<https://www.clubpenguinisland.com/parents/>>.
- Dube, N et al. 2017, 'The use of entertainment and communication technologies before sleep could affect sleep and weight status: a population-based study among children', *International Journal of Behavioral Nutrition and Physical Activity*, 19 July, vol. 14, no. 97.
- eduCBA 2016, *What is SPSS and how does it work?* viewed 23 December 2017, <<https://www.educba.com/what-is-spss-and-how-does-it-work/>>.
- Electronic Frontiers 2002, *Internet censorship: law & policy around the world*, viewed 6 November 2017, <<https://www.efa.org.au/Issues/Censor/cens3.html>>.
- Entertainment Software Rating Board 2017, *ESRB ratings guide*, viewed 19 Oct 2017, <https://www.esrb.org/ratings/ratings_guide.aspx>.
- Evans, R et al. 2009, 'Developing valid and reliable online survey instruments using commercial software programs', *Journal of Consumer Health on the Internet*, 21 February, vol. 13, pp. 42-52.
- Federal Trade Commission n.d., *Protecting kids online*, viewed 23 October 2017, <<https://www.consumer.ftc.gov/topics/protecting-kids-online>>.

- Federal Trade Commission 2011, *Parental controls*, viewed 30 October 2017, <<https://www.consumer.ftc.gov/articles/0029-parental-controls#tools>>.
- Fernald, A, Marchman, VA & Weisleder, A 2013, 'SES differences in language processing skill and vocabulary are evident at 18 month', *Developmental Science*, March, vol. 16, no. 2, pp. 234-248.
- Garcia-Sanjuan, F, Jaen, J & Jurdi, SE 2016, Towards encouraging communication in hospitalized children through multi-tablet activities. s.l., s.n.
- Gilles, G & Ford-Martin, P 2010, *Avoidant personality disorder*, viewed 23 October 2017, <<http://www.minddisorders.com/A-Br/Avoidant-personality-disorder.html>>.
- Google n.d., *Club Penguin Island*, viewed 26 October 2017, <https://play.google.com/store/apps/details?id=com.disney.clubpenguinremix_goo>.
- Gould, S & Loria, K 2016, *Here's why the iPhone's Night Shift mode is such a big deal*, viewed 25 August 2017, <<http://www.businessinsider.com/iphone-night-shift-blue-light-affects-your-brain-and-body-2016-4?IR=T>>.
- Hardell, L 2017, 'Effects of mobile phones on children's and adolescents' health: a commentary', *Child Development*, 15 May, vol. 89(1), no. 1, pp. 1-4.
- Hatch, K 2011, *Determining the effects of technology on children*, viewed 23 August 2017, <<http://digitalcommons.uri.edu/cgi/viewcontent.cgi?article=1212&context=srhonorsprog>>.
- Hiniker, A, Lee, B, Sobel, K & Choe, E 2017, *Plan & play: supporting intentional media use in early childhood*, Stanford, California, ACM, pp. 85-95.
- Hussain, A, Zahra, F & Kamal, F, 2016, 'Word blast: Modelling word edutainment game for children', *Advanced Science Letters*, 1 May, vol. 22, no. 5-6, pp. 1151-1155.
- Ibrahim, N, Ahmad, W & Shafie, A 2016, 'Effectiveness study on multimedia mobile application for children: Mfolktales', *Journal of Theoretical and Applied Information Technology*, 15 July, vol. 89, no. 1, pp. 269-277.
- Instagram 2017, *Instagram*, viewed 9 October 2017, <<https://www.instagram.com>>.
- Ito, M et al. 2010, *Hanging out, messing around, and geeking out: kids living and learning with new media*, London, The MIT Press.
- Keith, B & Steinberg, S 2017, 'Parental sharing on the internet child privacy in the age of social media and the paediatrician's role', *JAMA Pediatrics*, May, vol. 171, no. 5, pp. 413-414.
- Kim, Y 2013, *Young children in the digital age*, viewed 10 August 2017, <<https://www.unce.unr.edu/publications/files/cy/2013/fs1322.pdf>>.
- Kirwil, L 2009, 'Parental mediation of children's internet use in different European Countries', *Journal of Children and Media*, 17 November, vol. 3, no. 4, pp. 394-409.

Lister, J 2009, *Technology has mixed effects on child development, research suggests*, viewed 7 September 2017, <<https://www.infopackets.com/news/4266/technology-has-mixed-effects-child-development-research-suggests>>.

Lorah, E et al. 2014, 'Within stimulus prompting to teach symbol discrimination using an ipad speech generating device', *Journal of Developmental and Physical Disabilities*, 25 February, vol. 26, no. 3, pp. 335-346.

Lwin, M, Stanaland, A & Miyazaki, A 2008, 'Protecting children's privacy online: how parental mediation strategies affect website safeguard effectiveness', *Journal of Retailing*, June, vol. 84, no. 2, pp. 205-217.

Marsh, J et al. 2005, *Digital beginnings: Young children's use of popular culture, media and new technologies*, viewed 10 August 2017, <https://www.researchgate.net/profile/Greg_Brooks/publication/265183910_Digital_beginnings_Young_children's_use_of_popular_culture_media_and_new_technologies/links/5473599e0cf2d67fc036d3df/Digital-beginnings-Young-childrens-use-of-popular-culture-media-and-new-technologies.pdf>.

McNaughton, D 2013, 'The iPad and mobile technology revolution: benefits and challenges for individuals who require augmentative and alternative communication', *Augmentative and Alternative Communication*, 27 May, vol. 29, no. 2, pp. 107-116.

Meyer, B 2016, Handling knowledge through the iPad: new engagements in learning. In: European Conference on e-learning. Academic Conferences International Limited, pp. 483-490.

Miller, K et al. 2016, 'A prospective randomized controlled trial of nonpharmacological pain management during intravenous cannulation in a pediatric emergency department', *Pediatric Emergency Care*, 1 July, vol. 32, no. 7, pp. 444-451.

Mora-Guiard, J, Crowella, C, Paresa, N & Heaton, P 2017, 'Sparking social initiation behaviors in children with Autism through full-body Interaction', *International Journal of Child-Computer Interaction*, January, vol. 11, pp. 62-71.

Morgan, H & Lea, G-L 2017, 'Egyptian children's use of technology: a phenomenological study', *Journal of Research in Childhood Education*, 4 Jan, vol. 31, no. 1, pp. 113-121.

Nintendo 2017, *Nintendo Switch Parental Controls mobile app*, viewed 30 October 2017, <<https://www.nintendo.com/switch/family-fun/parental-controls/>>.

Nintendo n.d., *Nintendo support*, viewed 30 October 2017, <<http://en-americas-support.nintendo.com/app/answers/landing/p/696/c/184>>.

Nintendo n.d., *Parental controls*, viewed 30 October 2017, <<https://www.nintendo.co.uk/Support/Wii-U/Parental-Controls/Overview-678628.html>>.

Oliver, C 2017, A review of the relationship between screen time and low levels of physical activity with obesity and sedentary behaviors in children and adolescents, viewed 21 September 2017, <http://scholarworks.gsu.edu/cgi/viewcontent.cgi?article=1062&context=iph_capstone>.

OurPact 2016, *The essential app for parents OurPact parental control & family locator*, viewed 23 October 2017, <<http://ourpact.com>>.

Parental Controls n.d., *Nintendo 3DS*, viewed 30 October 2017, <<http://cdn.parentalcontrols-on.org/assets/images/steps/nintendo/3ds/5.jpg>>.

Pickerill, M., 2015. *7 Ways to Monitor Your Kid's Phone, Tablet and Laptop*. [Online] Available at: <http://time.com/3663811/7-ways-to-monitor-your-kids-phone-tablet-and-laptop/> [Accessed 10 August 2017].

Radesky, J, Schumacher, J & Zuckerman, B 2015, 'Mobile and interactive media use by young children: the good, the bad, and the unknown', *Pediatrics Perspectives*, January, vol. 135, no. 1, pp.1-3.

Rettner, R 2016, '*Pokémon Go*' catches high praise from health experts, viewed 10 August 2017, <<https://www.livescience.com/55373-pokemon-go-exercise.html>>.

Rowan, C 2009, *Technology overuse on child sensory development*, viewed 23 August 2017, <<http://www.zoneinworkshops.com/pdf/Summer2009-OTLine-Technology-overuse-on-child-sensory-development.pdf>>.

Rowan, C 2013, *The impact of technology on the developing child*, viewed 7 September 2017, <http://www.huffingtonpost.com/cris-rowan/technology-children-negative-impact_b_3343245.html>.

Sendra, S, Parra, L, Llore, J. & Tomás, J 2017, 'Smart system for children's chronic illness monitoring', *Information Fusion*, 13 June, vol. 40, pp. 76-86.

Sesame Street 2017, *Elmo loves ABCs lite*, viewed 30 October 2017, <<https://itunes.apple.com/au/app/elmo-loves-abcs-lite/id427847605?mt=8>>.

Snapchat 2017, *Snapchat*, viewed 12 October 2017, <<https://www.snapchat.com/l/en-gb/>>.

Solon, O 2016, *Does spending too much time on smartphones and tablets damage kids' development?* viewed 23 August 2017, <<http://www.independent.co.uk/life-style/health-and-families/does-spending-too-much-time-on-smartphones-and-tablets-damage-kids-development-a7067261.html>>.

Sprigg, S, Swart, H & James, M 2013, *Intelligent parental controls for wireless devices*. USA, Patent No. US 20130017806 A1.

United States Department of Justice 2016, *Children internet safety*, viewed 9 October 2017, <<https://www.justice.gov/criminal-ceos/children-internet-safety>>.

Unwin, J 2016, *A glimpse into the dystopian future of technology-centered parenting*, viewed 9 November 2017, <<https://qz.com/863511/technology-obsessed-parents-will-create-a-dystopian-future-for-the-next-generation-of-children/>>.

Vancouver Coastal Health 2017, *Equipment evaluation services - equipment loans*, viewed 7 September 2017, <<http://www.assistive-technology.ca/eqloan.html>>.

Vandewater, E & Denis, D 2011, 'Media, social networking, and pediatric obesity', *Pediatric Clinics of North America*, December, vol. 58, no. 6, pp. 1509-1519.

Waclawski, E 2012, *How I use it: Survey Monkey*, viewed 23 December 2017, <https://www.researchgate.net/profile/Eugene_Waclawski2/publication/230723255_How_I_use_it_Survey_Monkey/links/56c32bec08aeeaf199f8bfec/How-I-use-it-Survey-Monkey.pdf>.

WeLiveSecurity 2015, *Why parents must teach their children about internet security*, viewed 9 October 2017, <<https://www.welivesecurity.com/2015/09/25/parents-must-teach-children-internet-security/>>.

Whitaker, B 2001, *Losing the Saudi cyberwar*, viewed 9 November 2017, <<https://www.theguardian.com/world/2001/feb/26/saudi-arabia>>.

Wiley, B, Cameron, D, Gulati, S & Hogg, A 2014, 'Exploring the use of tablets (iPads) with children and young adults with disabilities in Trinidad', *Disability and Rehabilitation: Assistive Technology*, 8 April, vol. 11, no. 1, pp. 32-37.

World Health Organisation 2016, *Commission on ending childhood obesity*, viewed 21 September 2017, <<http://www.who.int/end-childhood-obesity/en/>>.

World Health Organisation 2016, *Obesity and overweight: fact sheet*, viewed 21 September 2017, <<http://www.who.int/mediacentre/factsheets/fs311/en/>>.

World Health Organization 2011, *Safety and security on the Internet*, viewed 2 November 2017, <http://www.who.int/goe/publications/goe_security_web.pdf>.

Xin, J & Leonard, D 2015, 'Using iPads to teach communication skills of students with autism', *Journal of Autism and Developmental Disorders*, December, vol. 45, no. 12, pp. 4154-4164.

Yannier, N, Israr, A, Lehman, J & Klatzky, R 2015, *Feel sleeve: haptic feedback to enhance early reading*. Seoul, ACM, pp. 1015-1024.

YouTube 2017, *YouTube*, viewed 12 October 2017, <<https://www.youtube.com>>.

APPENDIX A: SURVEY

This survey is being conducted by a Masters University student of Flinders University, Adelaide, Australia, and is completely voluntary. If you do not wish to complete this survey, then please feel free to abandon it or submit it incomplete. Thank you for your time.

General

1- What is your post code?

2- Please list your child's details. (Age, gender)

List	Age	Gender	Grade average at school
1			
2			
3			
...			

Focus (Children and Technology)

3- Your children all have exactly equal access to technological handheld devices. (They all have their own devices that they can access whenever they choose, and/or they share all shared devices equally.) Do you agree or disagree?

- I strongly agree
- I agree
- I neither agree nor disagree
- I disagree
- I strongly disagree

4- Your children all have similar devices. Do you agree or disagree?

- I strongly agree
- I agree
- I neither agree nor disagree
- I disagree
- I strongly disagree

5- What devices do your children under the age of eight have access to:

- Mobile smart phone
- iPad/tablet
- Gaming devices (Nintendo DS/Switch, PSP, etc)
- Wearable computers (Apple Watches/smart watches, Google Glass, etc)
- iPod/Music specific devices
- Other (please list) _____

6- Please list the top five games/apps that your child engages with this technology

- 1-
- 2-
- 3-

4-

5-

7- What's the reason your child uses technology the most?

- 1- Education (counting/reading games, etc)
- 2- Communication (email, FaceTime, etc)
- 3- Video watching (YouTube, Netflix, etc)
- 4- General entertainment (games, etc)

8- How often do you check your child's device/their browsing history/the games they play?

- Very regularly (eg. Once a day)
- Regularly (eg. Once a week)
- Sometimes (eg. Once a month)
- Rarely (eg. Once every six months)
- Never

9- How do you monitor your child's activities?

- Physically checking them yourself on a (semi)regular basis
- Through a parental preferences application/system
- By limiting their time on said devices (eg. timer/app/etc)
- Other (please describe) _____

10- If applicable, what kinds of parental control apps do you use? Please list/name them.

11- How much freedom do you give your child(ren) on deciding on apps/games/devices?

- Total freedom
- They must ask my permission but I don't check their devices/pockets to ensure honesty
- I pay for all (paid) apps, games and devices and thus enforce my permission (they cannot get app/game/device without my permission/knowledge)
- I regularly physically check their device/apps, even after I give them permission
- They are not allowed to have any new apps/games/devices and only have the bare essentials that I have permitted (family-orientated/shared devices)
- They are not allowed contact with technology in any shape or form

12- How much time per day would you say your children spend on handheld devices?

- Never
- Less than 15 minutes
- Between 15 – 30 minutes
- 30 minutes – 1 hour
- 1 – 2 hours
- 2 – 3 hours
- +3 hours (please list _____)

13- Have you seen any major physical differences/problems with your child as a result of their gaming/socialising habits?

- Weight problems
- Eye problems
- Movement problems
- Sleep problems
- Other

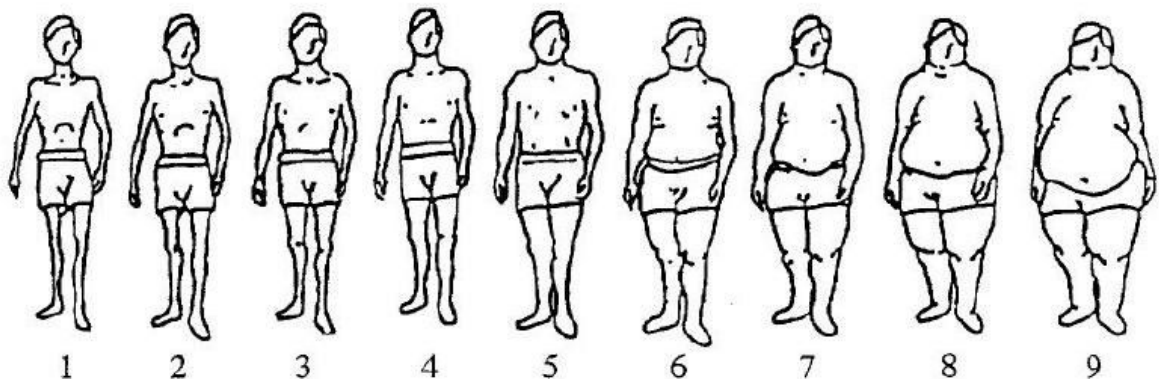
14- How old were your children when they started using handheld devices?

- One year to two years
- Three years to four years
- Five years to six years
- Seven years to eight years
- Other

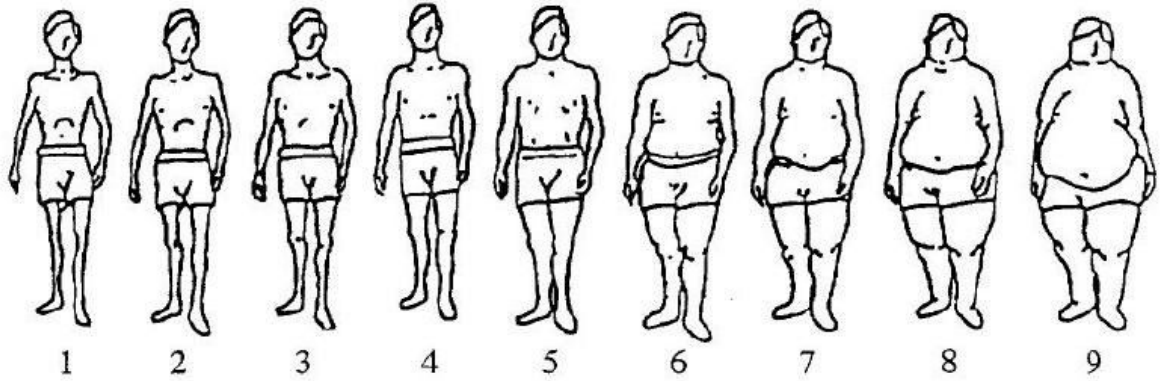
15- How often do your children use handheld technology within the classroom?

- Never
- Less than 15 minutes
- Between 15 – 30 minutes
- 30 minutes – 1 hour
- 1 – 2 hours
- 2 – 3 hours
- +3 hours (please list _____)

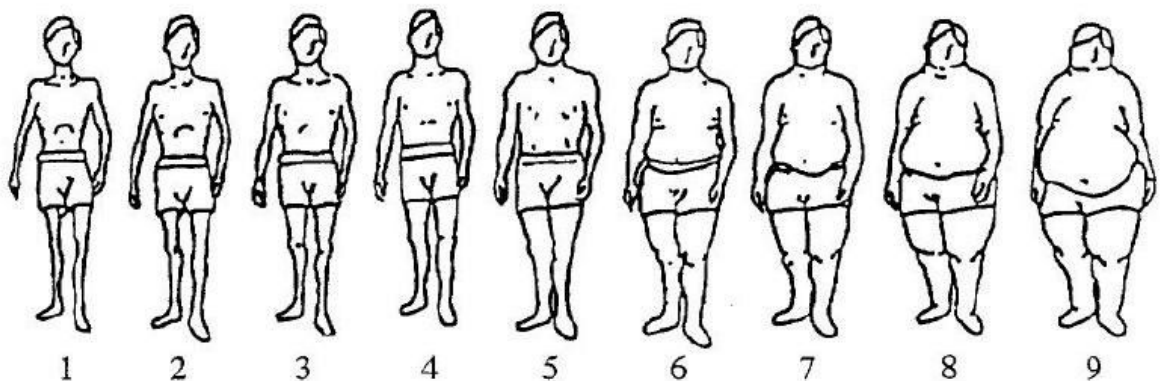
16- If you had to classify your oldest child as one of these body sizes, which would you select?



17- If applicable, if you had to classify your second oldest child as one of these body sizes, which would you select?



18- If applicable, if you had to classify your third oldest child as one of these body sizes, which would you select?



19- How regularly do your children see their doctors/dentists/optometrists/other specialized physical practitioners?

- As often as is recommended by said practitioners (every six months to a year)
- Less regularly than is recommended by the above (every year to two years)
- Rarely (every two to three years)
- Extremely rarely (every three to four years)
- Other (Please list _____)

20- Have your children ever been seen by a therapist/psychiatrist/psychologist/other mental health specialist, and if so how many times? (This is in regards to their overall mental health check ups, not if the child requires regular visits due to non-technologically related non-neurotypical quirks.)

- Never
- Once
- Twice to three times
- Four or more times

Society

21- In two to three sentences, what is your opinion of mobile devices on children in society?

22- In two to three sentences, what is your opinion of handheld gaming/music devices on children in society?

- 23- In two to three sentences, what is your opinion on the advance of technology on the whole as we proceed into the future, particularly on how it will influence children?
- 24- Children are at risk by strangers/predators when they play on these devices. Do you agree or disagree?
- I strongly agree
 - I agree
 - I neither agree nor disagree
 - I disagree
 - I strongly disagree
- 25- Children are at risk of mentally/physically detrimentally damaging factors when they play on these devices. Do you agree or disagree?
- I strongly agree
 - I agree
 - I neither agree nor disagree
 - I disagree
 - I strongly disagree
- 26- The continued use of smartphones negatively affects the educational level of children. Do you agree or disagree?
- I strongly agree
 - I agree
 - I neither agree nor disagree
 - I disagree
 - I strongly disagree
- 27- Mental/physical illness and isolation may result from the use of smart phones from children. Do you agree or disagree?
- I strongly agree
 - I agree
 - I neither agree nor disagree
 - I disagree
 - I strongly disagree
- 28- Many children use smart phones to compensate them for the deprivation of friends. Do you agree or disagree?
- I strongly agree
 - I agree
 - I neither agree nor disagree
 - I disagree
 - I strongly disagree
- 29- I think the use of smart phones is a sign of prosperity and a high economic level. Do you agree or disagree?
- I strongly agree
 - I agree
 - I neither agree nor disagree

- I disagree
- I strongly disagree

30- Do you think your child(ren) spend an excessive amount of time on their devices?

- Strongly agree
- Yes
- Neither yes nor no
- No
- Strongly disagree

31- How much time does your child spend on technology/how dependant are they?

[INSERT SLIDING SCALE OPTION FOR SURVEYMONKEY]

32- Violent and murderous videogames can negatively affect children's psychology. Do you agree or disagree?

- I strongly agree
- I agree
- I neither agree nor disagree
- I disagree
- I strongly disagree

33- Children's social skills can be positively affected by technology. Do you agree or disagree?

- I strongly agree
- I agree
- I neither agree nor disagree
- I disagree
- I strongly disagree

34- Children's learning skills can be positively affected by technology. Do you agree or disagree?

- I strongly agree
- I agree
- I neither agree nor disagree
- I disagree
- I strongly disagree

35- Children's problem-solving skills can be negatively affected by technology. Do you agree or disagree?

- I strongly agree
- I agree
- I neither agree nor disagree
- I disagree
- I strongly disagree

Focus on Parents

36- What kinds of devices do you use, as a parental figure?

- Mobile smart phone
- iPad/tablet
- Gaming devices (Nintendo DS/Switch, PSP, etc)
- Wearable computers (Apple Watches/smart watches, Google Glass, etc)
- iPod/Music specific devices
- Other (please list) _____

37- How much time do you spend on handheld devices for leisure on average per day?

- Less than 15 minutes
- Between 15 – 30 minutes
- 30 minutes – 1 hour
- 1 – 2 hours
- 2 – 3 hours
- +3 hours (please list _____)

38- When you are spending time with your child(ren), how much of that time is spent on handheld devices? (%)

- All available time spent on devices
- About 3/4 of time spent on devices
- About half of time spent on devices
- About 1/4 of time spent on devices
- Less than 1/4 of time spent on devices
- No time spent on devices, all time spent doing other non-technology related things

39- How much time do you spend on your devices (generally) per day?

- Less than 15 minutes
- Between 15 – 30 minutes
- 30 minutes – 1 hour
- 1 – 2 hours
- 2 – 3 hours
- 3 – 6 hours
- +6 hours (please list _____)

40- What industry/field are you or your partner (if applicable) in?

41- What age bracket do you fit into? Please select.

- 18-25
- 25-30
- 30-35
- 35-40
- 40-45
- 45-50
- 50-55
- 55+

42- What is you or your partner's highest level of education you have achieved?

- High school education
- Diploma/certificate in a trade (ie TAFE degree)
- Undergraduate degree
- Postgraduate degree (Diploma)
- Postgraduate degree (Masters)
- Postgraduate degree (PHD)
- Higher/more than one undergrad/postgrad degree
- Other tertiary education
- None of the above

Thank you once again for your time in completing this survey, please be reassured that all information collected will be completely confidential and is being collected for the purposes of a study being conducted by a masters student at Flinders University, Adelaide, Australia.