TECHNOLOGICAL TRENDS AND THEIR CONSEQUENCES ON CHILDREN AND ADOLESCENTS

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ABSTRACT

Today in the modern world, the importance and usefulness of technology in our daily lives cannot be denied due to its countless benefits. With its increased usage, technology has made a profound impact on human life. This impact is not always positive and has caused nuisance in various aspects to humanity especially children. Research shows that these adverse effects are not limited to mental and physical health of young ones, but have also been the reason behind their behavioral issues. These harmful consequences can be managed somehow if we can figure out how various technologies influence children. Hence, this qualitative research was intended to determine the technological trends among young children of 1 to 9 years and adolescents aging 10 to 19 years in Pakistan and measure their consequences. This study was also aimed to provide design interventions to engineers for future devices in order to reduce these technological hazards.

To meet this objective, data was collected through purposive sampling by means of semi-structured interviews. Data analysis was done using NVivo software to assess the influence of different technologies as well as digital content on children from behavioral perspective. Both individual and social behaviors were examined for both age groups. Findings indicated that electronic devices particularly televisions, laptops and mobile phones have proved to be beneficial for children by elevating their knowledge, learning and creativity. However, maximum harmful effects such as aggression, addiction and stubbornness are also associated with these devices. In the same way, digital content like learning-based and entertainment videos and games have a positive contribution as they make children more informed and confident. Whereas, they are also a source of adverse effects e.g. disturbed sleep, poor eating habits, weak family bonding and reduced physical activities. Both age groups of children are facing unfavorable outcomes of technology with young children reflecting negative behavior mainly through aggression and irritability while adolescents are becoming stubborn and moody. Restricted content access, strict parental control, introducing child profiles with limited content and provision of electronic devices for learning only are some of the recommended measures which can lessen these technology jeopardies.

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CHAPTER 1

INTRODUCTION

1.1 Motivation

Technology plays a significant role in our daily routines not only by letting us do our work with comfort and ease, but also serving mankind as a great source of entertainment, especially children. The young ones begin to spend significant amount of time with electronic devices and media from early years of life as their parents find it an easier and convenient way of keeping their children engaged for hours. This technology usage considerably influences children in terms of making both positive and negative impact on them. However, research shows that negative consequences of technology usage are much higher on children in context of their behavior and physical and mental health. Furthermore, the long-term health risks among children and adolescents have not been explored much since the previous generations of this age group were never exposed to these harmful radiations [1]. In consideration of these effects, European, Middle East region and developed countries have explored technology trends in various dimensions. But unfortunately, Asian countries, specifically Pakistan lacks behind in finding and understanding the impact of technology on children. That is why, this research is an attempt to enquire technology trends and their consequences on different age groups of Pakistani children. These groups are divided into young children aged 1 – 9 years and adolescents of 10 – 19 years to examine the impact of all types of electronic devices and digital media which they use.

1.2 Problem Statement

Technology usage is not always beneficial and may also cause harmful effects in various forms. This severe impact turns into serious mental, physical and behavioral deterioration with continuous and increased practice. Among different affectees, research reveals that children are most influenced due to their absorbent minds. Unfortunately, reports indicate that studies have been conducted in this domain for adults but limited research has been done for children and adolescents [2]. Moreover, the devices with which children engage, have also failed to restrict them effectively despite various controlling features e.g. parental lock, separate children profiles and Apps. These detrimental effects can be managed by identifying impact of various technologies and adopting precautionary measures timely and affectively. Therefore, this study intends to determine underlying impact of technology on Pakistani children and adolescents by examining their device usage and content accessed. It also aims to highlight the problems associated with current electronic devices and proposes amendments for future gadgets to lessen these negative consequences.

1.3 Background

Undoubtedly, in this modern era, technology has revolutionized our lives in innumerable ways. Other than being a main source of entertainment, it provides a wide range of support in various fields of life including learning applications and systems in education and industrial sectors, maintenance of health through fitness and medical equipment, assisting housewives in daily tasks by supplying kitchen and cleaning appliances, aiding banking sectors by introducing online banking and other services, bringing everything to our doorstep through online shopping, etc. Hence, in short, technology makes everything accessible with just a click [3].

In consideration of these countless benefits, technology utilization by children is much appreciated by education and industrial sectors to let them face modern world challenges as it helps individuals in developing and enhancing basic skills. Particularly children can improve skills through technology intervention in the form of interactive games and animated and three-dimensional models [4].

Despite the usefulness of technology, the adverse effects associated with it raises concerns of parents on the increased use of different devices and media including mobile phones, television, tablets, internet and video games [5]. According to research, these technologies are used by children for almost three hours [5] and communication technology like social media and networks connect more than 500 million people worldwide. These technologies are not only becoming a serious threat to children by making them addicted and neglecting other key aspects of life, but also affect them in context of their social, emotional, physical and cognitive wellbeing. Social issues consist of cyber-bullying, less physical interactions and isolation. Emotional problems comprise of accessing inappropriate content, addiction and depression [4]. Physical health risks include bones and muscles issues due to constant posture for hours and repetitive movements, risk of accidents while using during driving and obesity because of low interest in physical activities. Lastly cognitive issues are less time for creativity, low problem solving and learning skills, and having short attention span [6]. In concern of these numerous problems, parents are greatly challenged while maintaining a balance between technology exposure and limiting its use [7].

Research reveals that technology usage among youth is common in all age groups, which has specifically increased for adolescents in recent years as they spend hours in playing games on tablets and smart phones, use social media and remain busy in texting [8] [9] [10]. This trend of using social media is constantly growing among adolescents as they are getting involved in media tasking, i.e., using more than one media at a time [11]. It is also evident that developmental needs of adolescents are fulfilled with digital media by allowing them to independently connect and communicate socially [12]. As a consequence, media consumption in adolescents (especially of age 11 – 17 years) is quite high in comparison to children [10]. This consumption in adolescents is equal to that of adults [13].

Technology utilization by adults is greater but still research shows that children are more vulnerable to any health hazard [14] and face more cognitive, social, psychological and biological changes which consequently raises concerns for their parents [15]. This is because younger brains grow faster than adults and hence, children absorb greater amounts of electromagnetic radiations [19].

This makes researchers more concerned in exploring adverse consequences of technology on minors and youngsters in different aspects such as [16] examined the risks associated

with technology usage on social and personal lives of children and discovered presence of depression and obesity in such children. Another study related television watching to the sedentary behavior of little ones and also as barrier in physical activities [17]. Other studies based on highlighting harmfulness of technology discovered disturbed sleep patterns among those adolescents who use devices in daytime and before bedtime [18], deteriorating effects of technology on sensory and motor development of children [19], and occurrence of various issues in children due to early exposure of television [20].

Literature indicates that early years serve as a building block in lives of the children as health behaviors are developed in this period. These behaviors can be controlled by parents due to dependency of children on them [21]. According to research, a direct connection exists between parents' screen viewing and that of children and hence, children are greatly influenced by their screen viewing behaviors. In this regard, parents can make a significant difference in children's screen viewing by restricting their digital media usage. But still they do not show seriousness by taking necessary measures [22].

For this purpose, we have performed a qualitative investigation for assessing the outcomes of technology usage on children and adolescents in Pakistan. The study analyzed impact by interviewing parents of young children (1 – 9 years) and adolescents (10 – 19 years). Technology under study includes all electronic devices and digital media used by children of various age groups.

1.4   Scope

Taking into account the escalating utilization of technology by our younger generation, this research explores technology trends of Pakistani children. It is confined to children of one year till teenage i.e. 19 years old. For data gathering purpose, interviews from parents were held in main cities of Pakistan i.e. Islamabad, Lahore, Peshawar, Rawalpindi and Karachi. Other cities could not be addressed in the research due to resource and time limitations. All data were analyzed using NVivo 12 and assisted us to develop an understanding about technology trends of Pakistani youth. In addition to identification of technology trends, the study also presents positive and negative impact associated with various technologies,

comparative analysis between trends followed in developing and developed countries, role of parents in technology management and future directions about technology utilization.

1.5   Research Questions

The current research was carried out to determine technological trends among Pakistani youth in terms of most commonly used technology, time spent by children and adolescents on electronic devices, content accessed and physical activities, most frequently used electronic device and content accessed. Most influential device and content among both age groups, most influenced age group, impact (positive and negative) of technology on all ages were also identified. Moreover, parents' role in limiting technology usage and mitigating adverse effects associated with it were also investigated. Lastly future recommendations from view point of parents were presented.

The required information was retrieved through following research questions:

1. Which technology is most prevailing among children?
2. What impact does digital media have on children?
3. Which age-group of children is facing the most undesirable consequences?
4.   What adverse effects do various technologies pose for children?
5. Which technology trends are identified among children belonging to other developing countries?
6. How parental awareness can contribute in minimizing the technology risks?
7. What amendments can be introduced in new technologies to alleviate their devastating influence in children's lives?

1.6   Research Objectives

This study was conducted with following research objectives:

1. To identify which technology is most prevailing among children.
2. To determine the impact of digital media on children.
3. To identify the age group of children who is facing the most undesirable consequences.
4. To discover the adverse effects that various technologies pose for children.
5. To explore technology trends among children belonging to other developing countries.

6. To determine how parental awareness can contribute in minimizing the technology risks.

7. To examine what amendments can be introduced in new technologies to alleviate their devastating influence in children's lives.

1.7 Main Contributions

We made the following significant contributions while addressing the proposed research questions:

1. **Manifestation of Technology Trends:** We have presented technology trends found in children and adolescents of Pakistan through identification of most commonly used technology by both age categories and the time they spent with various technologies.

2. **Risk Assessment of Technology Utilization:** A key aspect of this research is the investigation of risks associated with the usage of various technologies. We also examined nature of risks involved (i.e. how their adverse effects are related to children) and what kind of harm can technology cause at child belonging to year 1 till teenage.

3. **Identification of ill-designed Technologies:** Another prominent feature of this study is the investigation of those technical designs which are causing negative impact on children and adolescents worldwide.

4. **Technology Intervention for Future Consumption:** Lastly, we have provided a comprehensive set of principles based on past literature and parents' viewpoint for future technology consumption. These principles can be adopted by engineers to design future gadgets in order to minimize the associated health risks. A guideline has also been provided for parents to restrict technology usage by their children thus, mitigating the underlying detrimental effects.

1.8 Thesis Outline

Remaining thesis is arranged in the following manner: relevant literature is provided in Chapter 2. Literature is divided into sub-sections, based on utilization of electronic devices

by children including television; computer, mobiles phones, laptops and other devices such as iPad, PlayStation and other gaming consoles. Chapter 3 describes complete research methodology and explains our research design, details of participants, sampling approach, sample size, data gathering and its analysis, respectively. Detailed data analysis is presented in first part of Chapter 4 while second section reveals our findings. Finally, we conclude our research in Chapter 5 by discussing overall technology trends identified in Pakistan's younger generation, their outcomes and future recommendations from viewpoint of responding parents.

CHAPTER 2

LITERATURE REVIEW

This section describes a general overview of technology trends followed by children across the globe in recent years. These trends are obtained by analyzing existing literature. For this purpose, relevant research papers were first classified, based on the focused electronic device. After classification, four groups were identified, namely: television, computer (also includes studies related to laptop and tablet), mobile phones and multiple devices (for exploring the impact of multiple device usage). The studies were classified with the aim of getting an explicit view of which device is commonly used by which age group of children and for what purpose.

2.1 Television

Unquestionably television is one of the leading technologies equally popular among children of all ages. For this reason, many researchers have focused on the use of television and its consequences from different dimensions e.g. a study carried by [20] examined if young children of 1-3 years with television exposure face attention problems later on at 7 years of age. Data was analyzed with the help of National Longitudinal Survey of Youth (NLSY). Results showed that 10% of the children with early age (1 – 3 years) television exposure experienced short attention span by the age of 7. It was concluded that substantial efforts need to be made to limit television usage of young ones. Similarly, [23] investigated the risks associated with television presence in bedrooms of children and adolescents in relation

to obesity. In this United States based study, a telephone survey was conducted to collect data from children aging 10-14 years. It was found that bedroom television was a major contributor of weight gain among children and adolescents. In another research [24], the influence of background television was studied for children living in United States. For this purpose, a survey was held which comprised of parents of children from 8 months to 8 years. Results indicated that young African American children were more involved in background television as compared to average US children who were experiencing nearly 4 hours on a daily basis. This high consumption of television resulted in poor cognitive functions and social play among children.

Similarly in another research, [25] studied the impact of food advertisements running on television on food preferences of children. The research subject were children of 8 to 14 years of age who gave taste and health rankings about 60 edibles. In this process, children first viewed food and nonfood commercials and were then tested. They were scrutinized during making food selections by using functional magnetic resonance testing. Findings indicated that the children who watched food TVC (Television Commercials) made biased food selections afterwards. Also, the effects of television commercials on behaviors of children was determined by [26]. The study consisted of children belonging to the age group of 1-19 years living in urban and rural areas of Bhopal, India. Questionnaires were used to investigate parents about their children's behavior. It was found that overall urban children exhibited more positive and negative influence of TVC as compared to rural children. At one end, they became more aware about oral health and hygiene. On the other hand, they also became more demanding.

In another relevant study [27], the effect of television viewing on child development was explored in terms of 12 senses of Rudolf Steiner's model. The research was aimed to identify the reason why television viewing is inappropriate for children below 3 years of age. Rudolf model included senses of life, thought, word, movement, touch, hear, vision, equilibrium, taste, warmth, ego and smell. Findings indicated risks associated with disturbed sleep and low concentration levels among young ones and suggested making useful decisions to safe future generations.

2.2 Computer

Today the use of technology by children is not confined to television and has gone beyond to other devices like mobile phones, computer, laptop, etc. Studies indicate that these technologies in frequent use of children whereas cell phones and personal computers are gaining more popularity with time. Therefore, it becomes necessary to explore the influence of these gadgets besides television. Investigators from all over the world made significant contribution in unveiling the usage and consequences associated with these devices particularly on minors as [28] investigated the outcome of computer usage on preschool children. The study examined various children's skills like cognitive, motivation, language development and social behavior by analyzing empirical data from 1985 to 2004. Findings were derived with the help of the development theories of Vygotsky, Piaget and Erikson. Results indicated positive influence on the lives of young children as computer exposure from childhood helps to improve interpersonal and cognitive capabilities as well as facilitate language development.

In another relevant research, [29] examined how computer exposure affects the understanding and functioning of children at their homes and schools. For this purpose, computers were provided to 167 children of 4-7 years of age, belonging to different socio-cultural backgrounds. Findings revealed that overall computer had a positive influence on children with young children more inclined towards fun activities such as games whereas older ones had a focus on learning activities. Suggestions included providing computer access to young schoolers in all settings to enhance their knowledge and creativity. Similarly, an effort was made by [30] to identify if there is a connection between creativity of children and their computer use. Parents were interviewed for this purpose and results showed that computer exposure significantly improve the creativity of children (both males and females) particularly with the help of video games.

Along with the benefits of improving skills and knowledge, computer also offers some adverse effects as [31] reviewed the literature to examine the risks previously discovered by researchers, related to CVS (Computer Vision Syndrome). Findings determined eye fatigue, headache, dry eyes (dysfunctional tear syndrome), double vision as the common symptoms of CVS. Authors provided a number of suggestions to avert the risk of CVS including

diagnosis and treatment of CVS, improve awareness of pathophysiology and importantly be vigilant about computer users particularly children.

Researchers also studied how laptops and tablets shape the everyday lives of children like [32] explored how laptop influence the self-concept development among children of 4-6 years of age. Children with limited financial resources took part in this research. They were classified into two categories: children in experimental group were offered tablets with 10 educational games whereas the control group children were provided no device at all. Group being tested was exposed to video games for less than 3 hours daily in their homes. Pre and post-tests of experimental group were held and presented same results regarding self-concept of this group. Overall, the two groups had no difference except with the increased curiosity levels among experimental group children. Also [33] made an investigation to assess the feasibility of using tablet in early years of childhood. To achieve this objective, the author recorded 41 preschool children (3-6 years) while they were involved with tablet. It turned out that children had a positive outcome of using tablet as they were effectively utilizing it for learning and sharing ideas. After being provided with a set of instructions, they quickly learned to use the tablet in an hour or less and were able to make drawings with it. It was further noted that amount of time spent with tablet had a direct relationship with the age group of children with older kids spending longer duration with tablets.

In the same manner, a study was conducted by [34] to explore the usefulness of Information and Communication Technology (ICT) in the lives of Madagascan children belonging to low-income families. In this mixed method research, a combined analysis was done using empirical observations, ICT history and interview sessions with parents and children. It was revealed that regular class activities are facilitated by laptop-based class activities e.g. learning-based games, browsing, creating texts and storyboards etc. Furthermore, the multi-purpose use of laptop also made it beneficial in everyday lives of children. As it supports information sharing, entertainment (music, videos and games) and education (homework assignments). Hence, it can be concluded that computer provides new learning opportunities to children and they explore new ways of self-expression under proper supervision.

2.3 Mobile Phone

Mobile phone is one of the electronic devices which are widely accepted around the globe. Thereby, many studies have been conducted to investigate its use in various aspects for instance [35] carried out a cross-sectional research to examine the technology usage of children aging 6 months to 4 years. The investigation was held at a pediatric clinic in which 350 children participated. Findings showed that majority of the children (96.6%) had mobile phones which they began using before the age of 1. It was also revealed that parents introduced their kids to these gadgets to engage them. Suggestions included raising awareness among people regarding limiting technology usage among children particularly infants. In another relevant study, [36] measured unfavorable consequences faced by mobile phone users. The research involved 266 individuals and it was identified that the more one is engaged with mobile phone, the more he/she is vulnerable to strain, depression and other physical and mental illnesses.

Furthermore, [37] assessed how mobile phone usage affects Taiwanese children and identified various health symptoms. In this cross-sectional study, 2042 children of 11-15 years of age participated through Computer Assisted Telephone Interview (CATI). During the interview sessions, parents specified how children used mobile phone and the resulting health deterioration. Results showed increased Adjusted Odd Ratios (AOR) regarding headache and skin irritation among children who were involved with mobile phone. Author suggested cautious mobile phone usage for children to minimize the exposure of electromagnetic waves releasing from its screen.

Also, [38] studied the mobile phone using trends of caregivers and minors during mealtimes. The research was carried out in a fast food restaurant using nonparticipant observational method. 55 parents with at least one child were observed while eating in the restaurant. Field notes were provided by observers giving details about parents and children device usage. Grounded theory methods were used for qualitative analysis of the field notes. With the help of generated themes, it was identified that while eating 40 parents were involved with mobile

devices. Also, parents more immersed with technology had a severe reaction towards troublesome kids.

With its various undesirable effects, mobile phone also offers countless benefits through its diverse applications. Many researches have been made to investigate this positive side of mobile phone as [39] presented a mobile application to assist learners suffering with autism. This App was accessible via cell phones as well as smart watches. In this investigation, participation of parents was very crucial as they would be turning the device on and off, selecting the words to learn and would also be recording the pronunciation of words. This application was designed to facilitate learning process of children suffering from autism by providing repetition of objects' names whenever children touched them. Findings showed that children made remarkable improvement in interpersonal and linguistic capabilities in no time comparing to those who learned without any such facilitation. Similarly, [40] developed a mobile App to support learning of Kadazandusun language. This Malaysian-based study was influenced by Technology Acceptance Model (TAM). By means of convenience sampling, a total of 300 students were selected out of which 100 belonged to college whereas 200 were from university. Self-administered questionnaires were used for data collection whereas data analysis was done in Analysis of Moment Structure (AMOS) using structural equation modelling. Positive response was received from students regarding mobile application as they perceived it as a beneficial learning tool for Kadazandusun language. Factors like user satisfaction, rich content and playfulness were also important in motivating individuals.

2.4 Multiple Electronic Devices

The exposure of technology is not limited to a single device but many users are involved with multiple electronic devices. Besides, the content like social media, video games, movies etc. which children access on these devices also significantly influence their health and behavior. This section covers the effects of multiple device usage as well as digital media. As an Iran based research [41] determined the association of screen time with psychometric well-being of youth. The research subject comprised of 14,274 children aging 7-18 years who were provided computer and television. Data was analyzed using regression modeling and it was found that children of 14 years and above were more vulnerable to psychological

health issues. Prolong duration of computer use caused problems like irritability, sleeplessness, feeling nervous and stomach aches whereas longer television exposure resulted in irritability and headaches. Hence, it can be deduced that prolong television and computer exposure is a prime cause of psychometric health issues among children and adolescents.

In another research, [42] conducted a literature review to measure the pros and cons associated with digital technologies which children and adolescents incur in everyday life. Results indicated that digital technology such as video games, social media, television etc. encourages skill building and learning if utilized effectively and with time constraint. It was suggested to adopt Family Media Use Plan to manage children's everyday activities.

Moreover, the association of Total Sedentary Time (SED) with Screen Time (ST) was evaluated by [43] for children of 9 to 11 years of age. In this regard, 21 potential correlates were assessed with the help of multilevel models. Findings showed a strong relationship exists between SED and ST amid obese children having fewer physical activities. The presence of television was also noted in the bedrooms of these inactive kids. It was recommended to increase the duration of physical activities along with the removal of television from the bedroom in order to provide a healthy lifestyle to the children. Also, a research [44] was carried out in Sweden focusing on the consequences of computer and television usage with respect to obesity and sleep among 10 years old. Data was collected through cross-sectional self-report survey in which 1260 grade 4 students took part. Weights and heights were also measured for these children during the survey. Multiple logistic regression, descriptive statistics and bivariant analysis were adopted for data analysis purpose. Findings revealed that 40% of the children were sleep deficient (taking less than 9 hours sleep) while 18% of them were overweight. Inadequate sleep had a direct relation with screen usage for more than 2 hours, tiredness, obesity and disturbed sleep. Therefore, children should restrict technology exposure and ensure proper adequate sleep.

Similarly, an investigation was made by [4] to study the outcomes of technology such as social media and video games on children. Data was collected with the help of surveys. It was found that media has a positive contribution in child development if they are exposed to useful content with time restriction. In another relevant research, [45] conducted a systematic

review over past 60 years to evaluate the consequences of violent content on youngsters' behavior. Violent content (particularly violence-based games) was provided to the viewers through electronic devices of daily use such as television, mobile phone and computer. Most of the literature reported negative behavior of youth after screen violence exposure. They developed aggressive thinking, anger, addiction, attention problems and insensitivity towards violence. They also became less kind and empathetic. Authors suggested choosing appropriate content which leaves positive outcome on health and behavior of the youngsters.

In the same way, the impact of gaming on sleep pattern and memory of children was studied by [46]. 11 school going children were allowed to do gaming on computer and television for long duration. Polysomnographic measurements were used to monitor the sleep patterns of these children. Memory performance was determined with the help of verbal and visual memory tests. Results indicated poor verbal memory and irregular sleep patterns among youth after prolong exposure to video games. Hence, it can be stated that excessive gaming has negative consequences on children's health. Also, [47] conducted a research to figure out if social media (email and messaging) has a relation with Time in Bed (TIB) and sleep deficiency among minors. For this purpose, 189 female students aging 8 to 16 years were selected. Children's Report of Sleep Patterns was used as a measuring tool. It was discovered that social media usage had a direct connection with insufficient sleep of its users but no association with TIB. Recommendations included not using social media at least an hour before bedtime to overcome inadequate sleep problem.

Another attempt was made by [48] to investigate the connection between technology usage and creative thinking among children of 12 years. Four varieties of technology namely mobile phone, computer, internet and video games were offered to 491 children belonging to different ethnic backgrounds. Torrance's test (1987, 1995) was used to design various dimensions of creativity measure. Findings revealed that video games contribute to creativity with high exposure to gaming resulting in greater creativity regardless of technology type, race and gender of the gamer.

Researchers have also focused on technology usage by infants as [49] carried out a study on media exposure of children ranging from 15 to 18 months. They were split into two categories: first category was engaged with viewing DVD while the second was introduced

to playing blocks. Salivary cortisol tests were conducted for each category of children. Results showed that children who were watching DVDs had lower cortisol levels and therefore, it was advised that toddlers (under 2) should only get a minimum exposure of technology i.e. maximum 1 hour per day. Besides, a literature review was done by [50] to examine the pros and cons of digital technology for infants. Various technologies included video games, mobile phone and television were explored for children less than 2 and findings indicated that technology possesses no harm for children if they use it for learning purpose with time limitation. However, it can cause some real damage to the physical and mental health of the young ones when they are over exposed to technology. Author suggested that parents should give limited technology exposure to children with proper guidelines from pediatricians.

In another relevant study [16], the adverse implications of multiple devices were examined for children under 8. Data was collected with the help of 1463 children using surveys. Various devices like television, mobile phone, iPad, laptop and iPod were included in the investigation. It was observed that almost all children owned a device whereas mobile phone and tablet were more popular among them. This early technology exposure was responsible for issues like social isolation, damaged personality etc. Parents were advised to play their part by sparing time for their kids and engaging them in physical activities of their interest.

Similarly, [51] conducted a research to inquire about the activities preschoolers (3-5 years) involve for literacy purpose. It was also aimed to explore the frequency with which parents make use of technology to educate the children. In this regard, longitudinal research studies i.e. Millennium Cohort Study (MCS), Effective Provision of Pre-School (EPPE) and Growing up in Scotland (GUS) were adopted by the researcher. Findings revealed activities like drawing, reading, narration and using electronic devices along with parents were common among these children. Moreover, children who were spending less time with parents were more inclined towards gadgets. Thus, it was recommended for parents to spend more time with children to minimize their technology exposure.

Another study by [18] focused on analyzing the technology usage by adolescents during day time and before bed time and how it influenced their sleep. In this cross-sectional research, 9846 teens (16-19 years) participated through a people centered study namely 'the

youth@hordaland'. It was observed that technology usage was the preferred activity of majority of the adolescents during day time as well as before bed time and it caused sleep deficiency among them. Suggestion included restricting technology exposure of the teens. Besides, a literature review was done by [19] to assess the influence of technology (computer, video games etc.) on children. Findings indicated that Technology facilitates learning process and skill development of children when use appropriately but brings adverse effects on children's lives when use without any restrictions. It was recommended that parents should allow technology exposure of children for limited time and for learning purpose only.

Another, qualitative research [52] was carried out in Europe to assess how various technologies influence children and their families. The use of multiple technologies like computer, mobile phone, tablet and video games was investigated in this pilot study. 10 families each with a 6-7 years old child and minimum one younger sibling, were selected from each European country. Details about children's technology usage, its associated benefits and risks and family response were collected and analyzed. It was identified that the outcome of digital world upon minor's well-being and behavior largely depends how they are introduced by parents and what limitations kids have regarding their usage. Another research [53] was aimed to study the association of internet use with psychological health among children of 4-7 grades. Data was collected through Pediatric Symptom Checklist-17 with the help of 737 children. Findings revealed that most of the children were using internet for different purposes and every 1 out of 5 children were facing psychological issues. Author suggested to raise awareness among parents regarding adverse effects of internet usage on children's health so that they could minimize their exposure.

Also, [54] explored the connection between intrinsic and extrinsic factors which influence the technology usage of school children. 1234 children contributed in data collection while analysis was done using path modeling. It was found that technology facilitates the learning process of educators and also provides ease to the instructors in delivering knowledge. Recommendations included adopting technology in education sector as it lifts the motivation of learners and helps them improve their imagination.

2.5 Design Interventions to Reduce Technology Hazards

Many efforts have been made by researchers to facilitate human-technology interaction and

to lower the underlying risks and hazards. In this regard, [55] addressed the scenario of engaging with dual-screen by mirroring one screen into the other. For instance, using mobile phones while watching television is a common practice and users have to change their gaze and posture resulting in problems like low attention span, eye strain and headache. The authors proposed a design intervention through display commonalities i.e. displaying the content of one screen within the other. The design was examined with professional broadcast practitioner and an empirical investigation was made to identify the most feasible method from design and user perspective. It was found that mirroring television screen onto a hand-held device like a mobile phone or tablet reduces the cognitive efforts to a greater extent. Similarly, in order to promote a healthy lifestyle [56] introduced a system namely UbiFit Garden based on design strategies. It is installed in mobile phones and uses its wallpaper to display a garden in which the number of flowers depends on how active an individual has been throughout the week. A butterfly appears once weekly goals are achieved. Results showed positive feedback by its users as it proved very beneficial in maintaining a physically active lifestyle.

In another research, [57] argued that by combining positive psychology and technology, we can certainly come up with positive technology i.e. technology which focuses on the well-being of its users. According to author, present technologies particularly social media cause harmful effects on the social bonding and welfare of the individuals. To control these negative consequences, technology creators must concentrate on developing positive technology and content which would shape the lives of its users in real sense. Also, [58] carried out a study to examine the effectiveness of blue light blocking glasses (BB) regarding sleep initiating mechanism against light emitting diode (LED) computer screens in evening. For this purpose, thirteen 15 – 17 years old male teenagers were exposed to LED screens for 2 weeks wearing BB or clear lens glasses in evening: 1 week to LED screens and 1 week to blue light enriched LED screens. Sleepiness, attention levels and salivary melatonin were regularly monitored for participants during this 2-week duration. Sleep patterns were also recorded using polysomnography. BB turned out to be a useful tool for minimizing salivary melatonin in teenagers, hence reducing alertness and vigilant attention before going to bed.

2.6 Problematic Electronic Device Features and their Impact on Users

Summary of problematic electronic device features and their impact on children and adolescents is given below in table 1.

Study	Device Feature	Impact on Users
[59]	Notifications and Auto-play features	Reinforcement of digital habits
[60]	Internet facility	Poor mental health and suicidal thoughts
[61]	Built-in games	Lower attention, control and emotional regulation
[62]	Emission of blue light	Shortened sleep duration
[63]	Radiofrequency electromagnetic fields from mobile phones	Difficulty in falling asleep
[64]	Easy access to media such as Facebook	Poor mental and physical health

Table 1: Summary of Problematic Device Features

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

We carried out a qualitative analysis to obtain answers of our research questions. For data collection, those individuals were approached who were actually experiencing the matters in question. These up-close particulars were collected through face-to-face conversation with parents of our research subjects i.e. children and adolescents. We approached parents for data gathering and not the children themselves because of two main reasons. Firstly, children (1 - 9 years) are too young to give accurate details and secondly, adolescents (10 - 19 years) may not judge themselves regarding their negative behavior and may be hesitant to talk about it. Data was collected by primary investigator through semi-structured interviews based on an interview guide. Data was analyzed by means of NVivo software. The aftermaths of technology and digital media on younger generation was assessed through data interpretation. Findings are discussed in detail in the final chapter. Figure 1 depicts our research methodology.
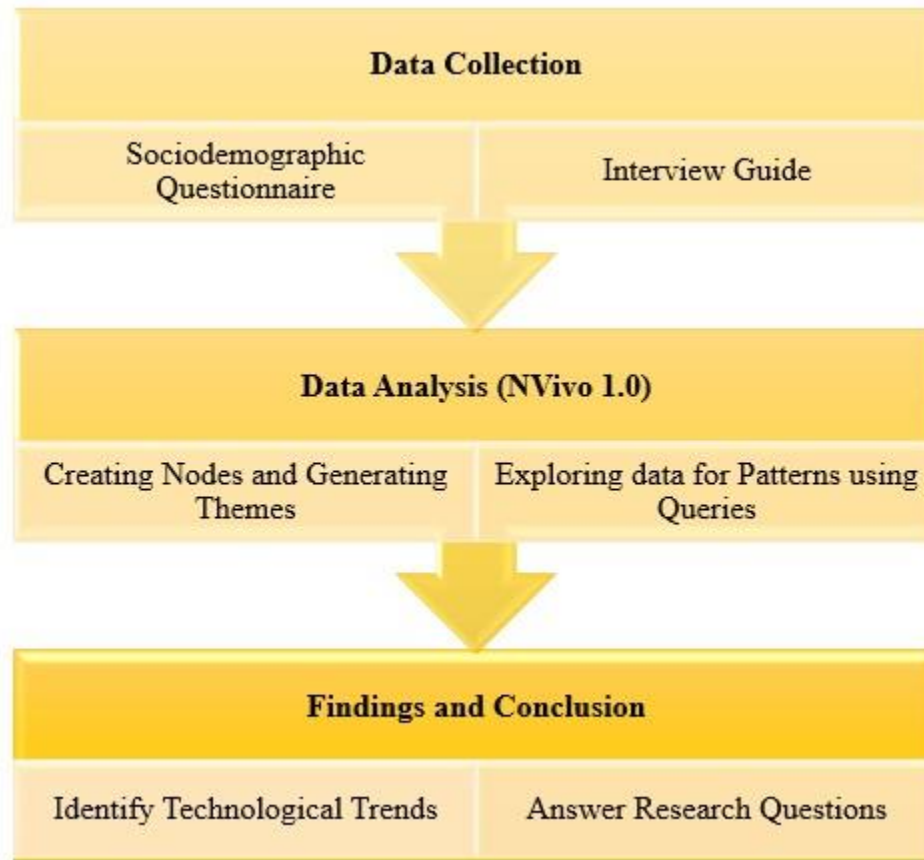
Figure 1. Research Methodology

3.2 Respondents

We categorized the interviewees in two groups. Group A comprised of young children from 1 to 9 years while group B covered adolescents aging 10 to 19 years. For both categories, data about technologies in use, most accessed electronic device, type of content they are exposed to, influence of various electronic gadgets and media on their lives and the pros and cons associated with the technology usage, was gathered. Appendix C refers to the interview guide.

3.3 Sample Size and Sampling Technique

In this investigation, purposive sampling was acquired as it is a non-probable sampling approach which allows participation of any number of participants based on their acquaintance with the subject matter [65]. We continued purposive sampling till we achieved

saturation and it was reached by means of 50 interviews covering of all ages ranging from 1 – 19 years.

3.4 Data Collection

For data gathering, semi-structured interviews were employed as the research instrument. Before advancing with the formal interview, approval for taken from each participant through a consent form (Appendix A). Moreover, population characteristics were gathered with the help of questionnaire.

Sociodemographic Questionnaire: Basic demographic data of children and their parents was collected through sociodemographic questionnaire. It comprised of details about age, gender, child's education, parent's occupation, income and city. It is available for reference at the end of document (Appendix B).

Semi-structured Interviews: Analytical data from parents was gathered by utilizing semi-structured interviews that encouraged participants to talk about the areas of concern. The interview questions were formed on the basis of a bunch of questions (interview guide) which assisted in focusing towards the research field [66]. Published literature was used as a reference for developing the interview guide [30] [38] [39] [67] [68] [69]. It included a total of 9 questions. Once trained adequately, the principal investigator conducted the interview sessions through one-on-one meetings with parents. Each interview lasted for 15-20 minutes. The interviews were audiotaped with interviewees' consent and were later transcribed. Statistics and other details obtained from the interviews were kept confidential as only the researcher was accessible to the research data.

3.5 Data Analysis

During data transcription process, interview data was organized in MS Excel and a serial number was assigned to each record. Data analysis was done using NVivo software version 12 taking into account that it allows researchers to analyze large volume of qualitative data in shorter time with greater accuracy [70]. Using NVivo, we created codes and child-codes and consequently, themes emerged. Graphical representation of data was achieved through

charts and coding. In the same way, Word Frequency Query was applied to discover most frequently occurring words whereas the connection of various items was determined by Group Query. Apart from that, Matrix Coding Query was used to find coding intersections between codes and attributes and to access the resulting matrix. Complete results of the analysis are presented in the upcoming section.

CHAPTER 4

DATA ANALYSIS AND FINDINGS

In this chapter our proposed research questions (in Chapter 1) are addressed. Here, we have presented comprehensive set of results obtained through data analysis using NVivo. Our collected data is based on demographic details of respondents, technology utilization by children and its impact on them from parents' perspective. Future recommendations for using technology from viewpoint of parents are also presented. The chapter concludes by providing cross-cultural comparison which comprises of technology trends among children of developing countries as compared to those of developed countries.

4.1 Demographics

This section provides an insight into demographic of parents who participated and their children.

4.1.1 Demographics of Parents

Demographic details of parents are based on following variables:

4.1.1.1 Age

Parents of different ages took part in our research, ranging from late 20s to more than 50 years old (age details are mentioned in figure 2).

4.1.1.2 Gender

Mothers and fathers had almost equal participation as figure 2 shows that out of 50 respondents, 24 were females and remaining 26 were males.
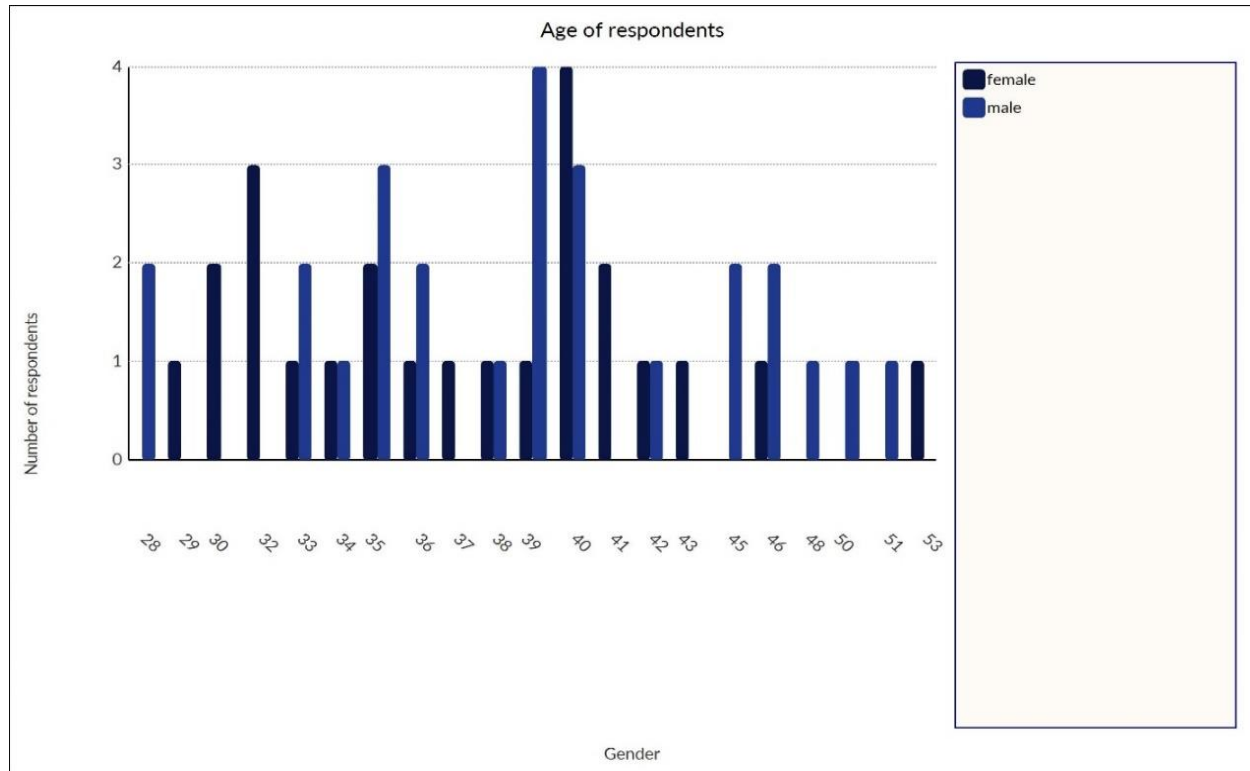
Figure 2. Parents' Age and Gender

4.1.1.3 Parents' Occupation

Occupation was asked on individual basis for both parents in order to enquire relationship between earning of parents and technology consumption by children.

4.1.1.3.1 Father's Occupation

Most of the fathers, i.e., 10 out of 50 (with reference to figure 3), were found to be government employees, whereas other major occupations were doctors and engineers (7 belonged to each profession). Other prominent fields included managers and businessmen.

4.1.1.3.2 Mother's Occupation

Mothers were almost equally identified as working and non-working (housewives). It was discovered that 26 (52%) mothers were housewives followed by doctors (9), governments officers (6) and teachers (4), respectively as presented in figure 4.
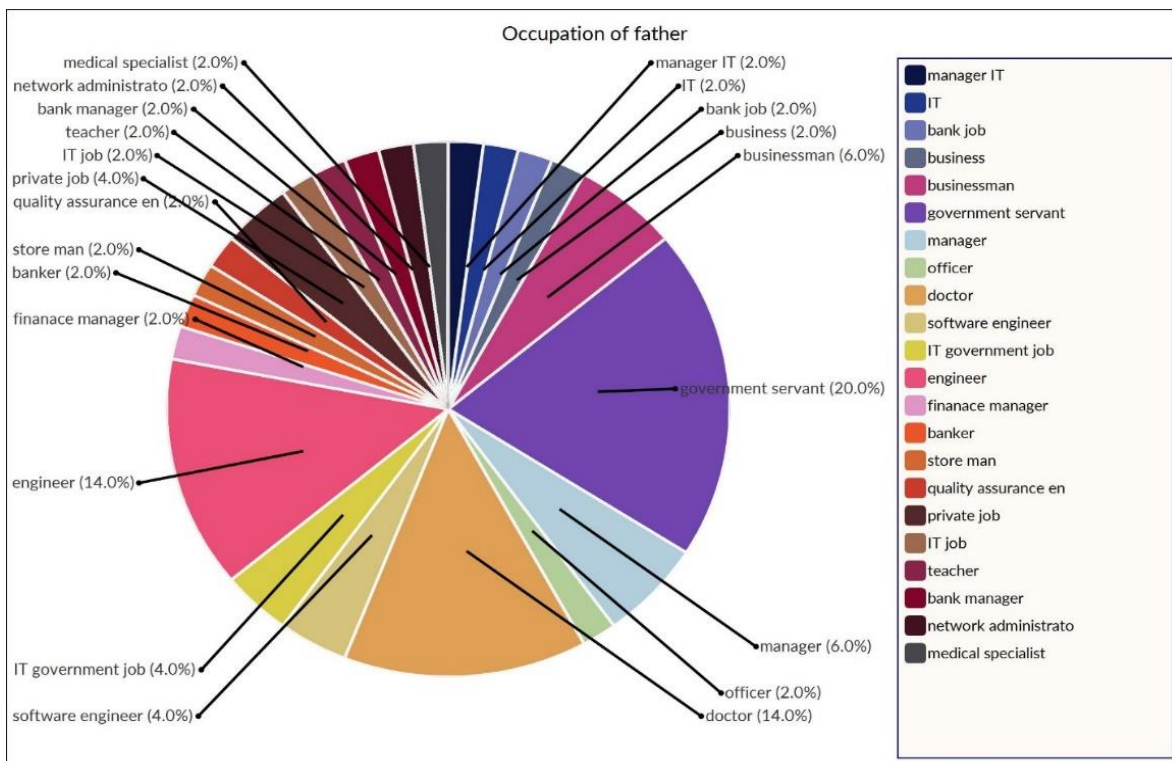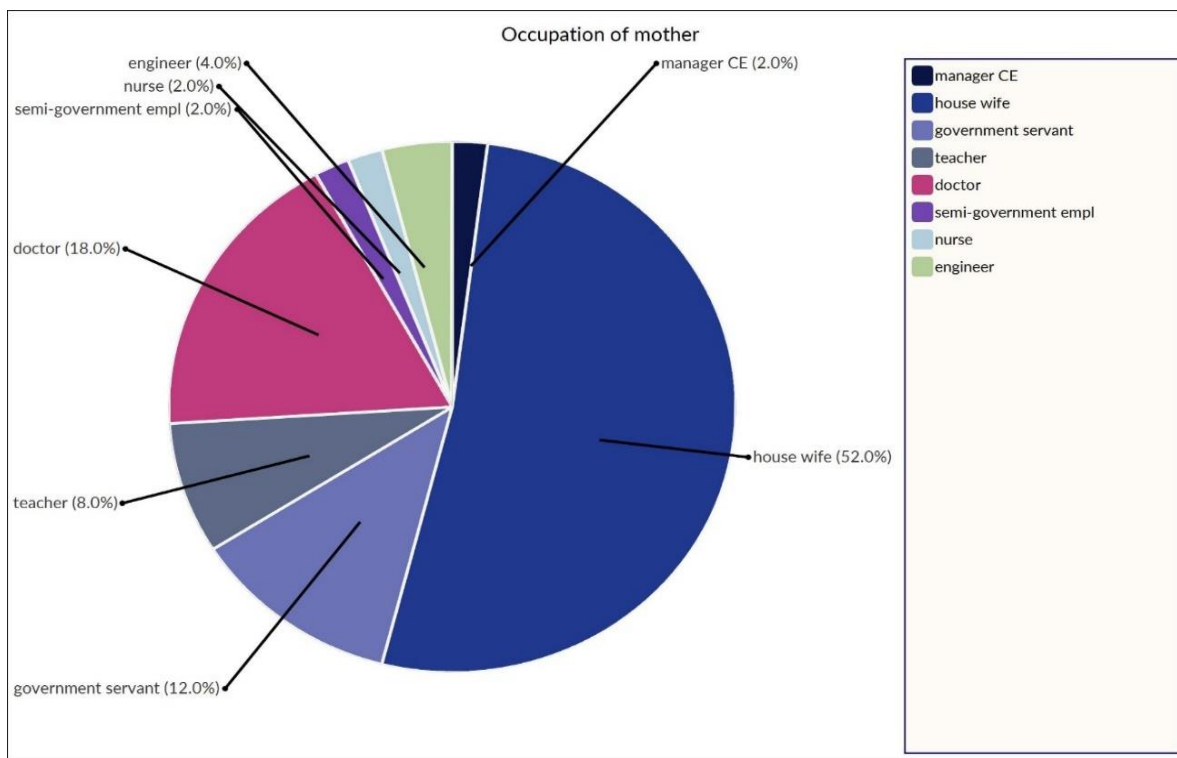
Figure 3. Occupation – Father

Figure 4. Occupation – Mother

4.1.1.4 Monthly Income

Parents' awareness about the use of technology can be examined if we figure out total earning of parents in connection with the technology consumption of their children. A direct relationship between earnings and technology usage indicates lack of awareness among parents. Hence figure 5 summarizes monthly income of each participated family, varied from PKR 45K to 500K.
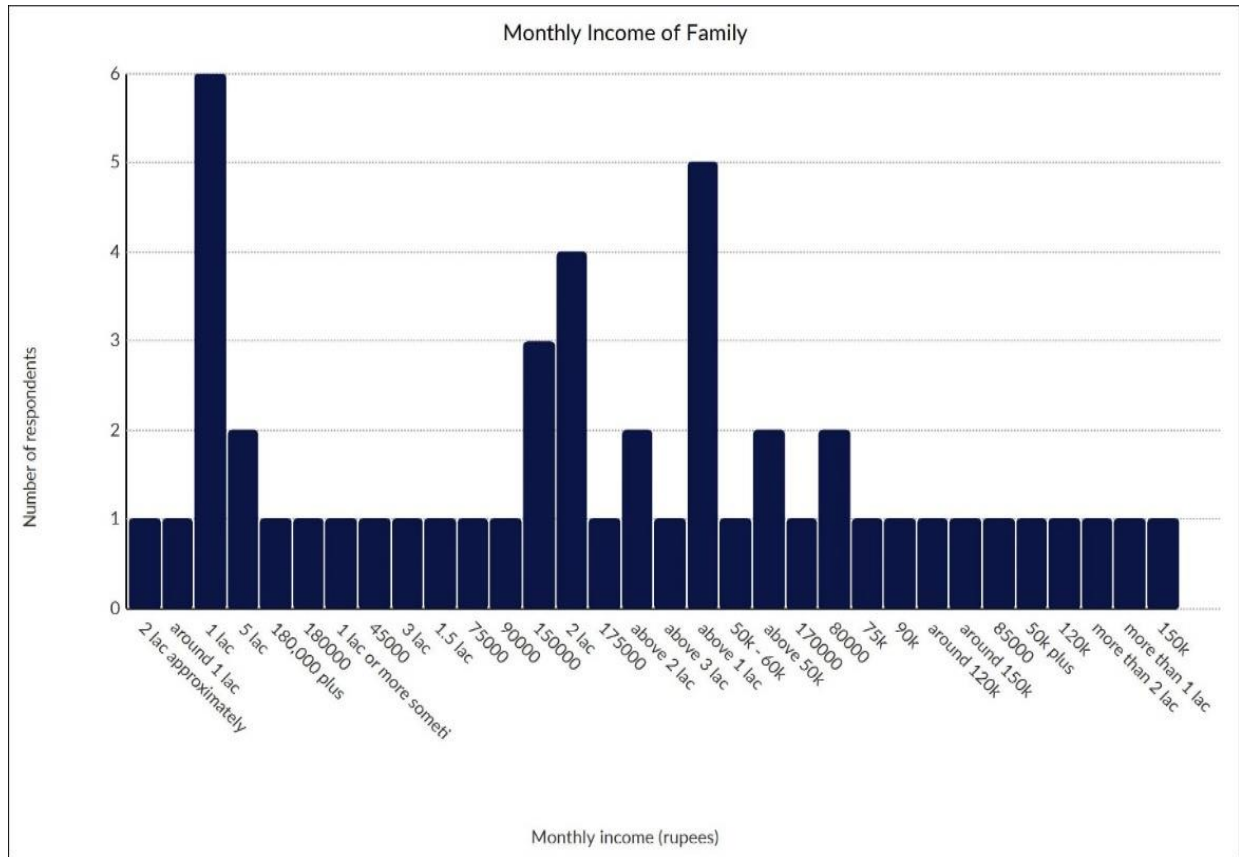

Figure 5. Family's Monthly Income

4.1.1.5 City

Resource and time constraints confined us to collect most of the data from twin cities of Islamabad and Rawalpindi. Other parents belonged to Lahore, Karachi, Peshawar and Abbottabad.

4.1.2 Demographics of Children

Demographic details of children are based on following variables:

4.1.2.1 Age

Since this study is based on children's technology trends, we were confined to two age groups: 1 – 9 years old children and 10 – 19 years old adolescents.

4.1.2.2 Gender

Children and adolescents of both genders were considered to explore whether technology utilization is associated with any specific gender. So total 24 adolescents' data was obtained. Among them, both males and females were 12 each. In 26 children, 15 were males and 11 females. Statistics of age and gender for both age groups are separately shown below (figures 6 and 7).
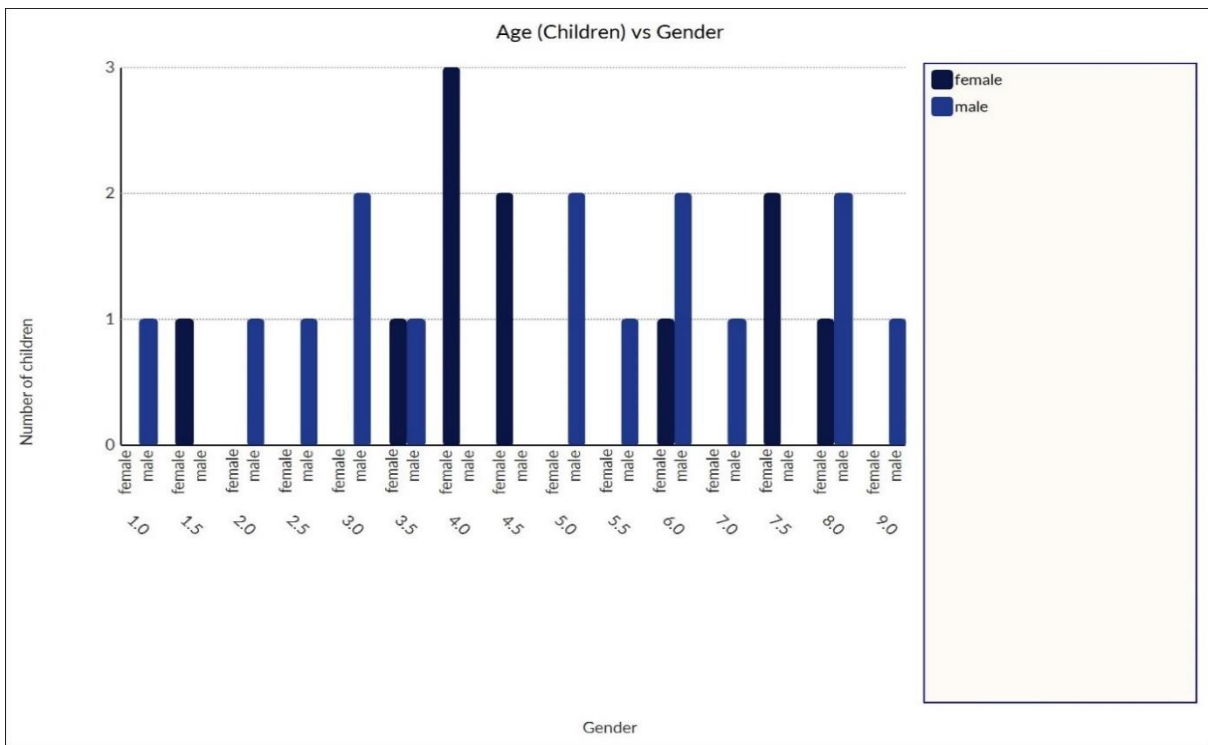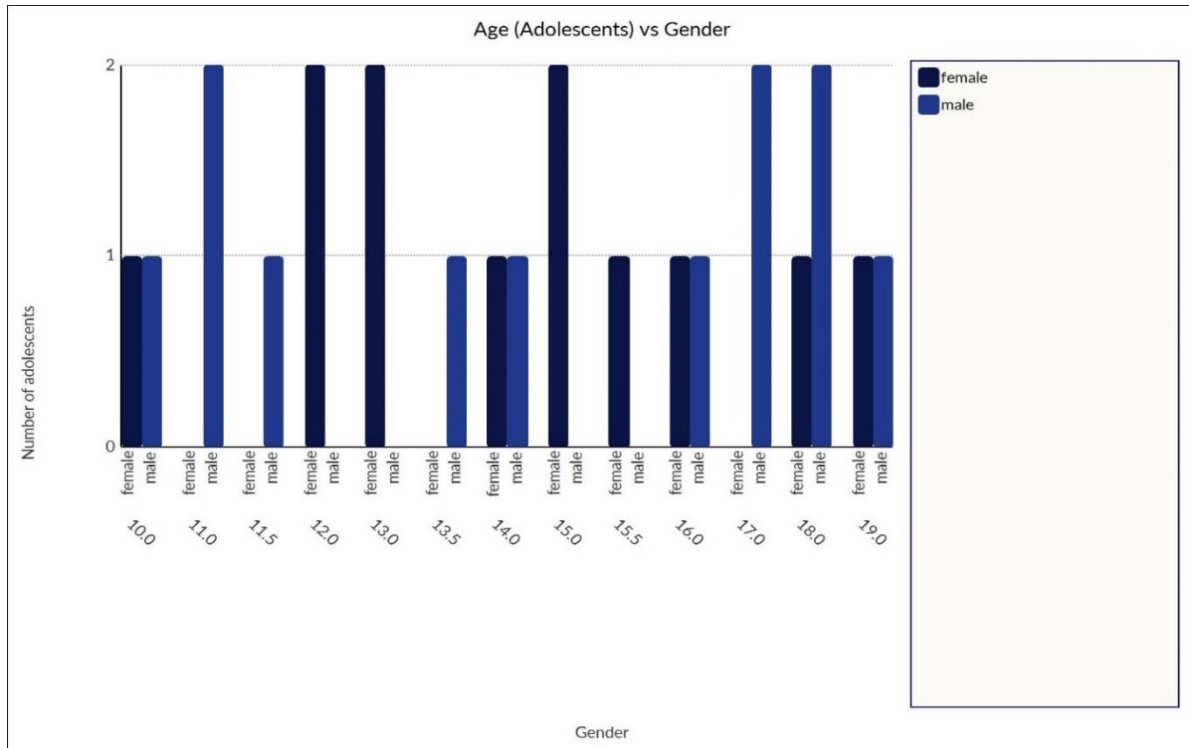

Figure 6. Children's Age and Gender

Figure 7. Adolescents' Age and Gender

4.1.2.3 Education

A mixed kind of data was found based on children's education level. Most of the children (9 out of 50) were less than of school age. Remaining students belonged to play group and kindergarten till those getting professional education. Significant amount of data came from adolescents of Grades 6 and 8 (4 adolescents belonged to each grade). Overall, our data reflected almost all education levels.
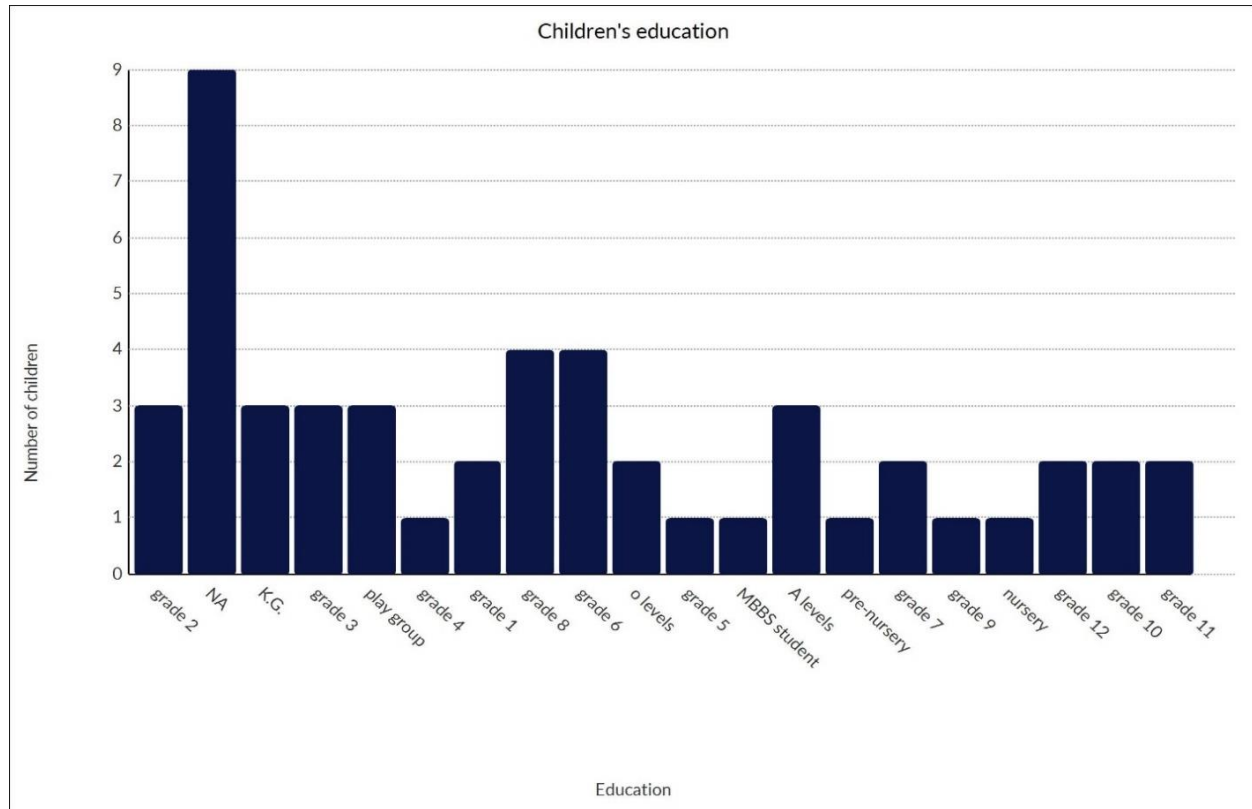
Figure 8. Education Level (Both Age Groups)

4.2. Technology Trends

A comprehensive analysis on technological trends followed by Pakistani children and adolescents is discussed below.

4.2.1 Trends followed by Children

Technology trends of Pakistani children are explored in this section on the basis of their daily utilization, most frequently used devices and commonly accessed content, and number of hours spent on electronic devices.

4.2.1.1 Popular Electronic Devices

Television is the most commonly used device by children followed by mobile phone. Other devices popular among children were iPad and tablet. Some children also used laptop and computer. Xbox was noticed to be used by only one child whereas none preferred play station and iPod.

Figure 9. Electronic Devices Usage by Children
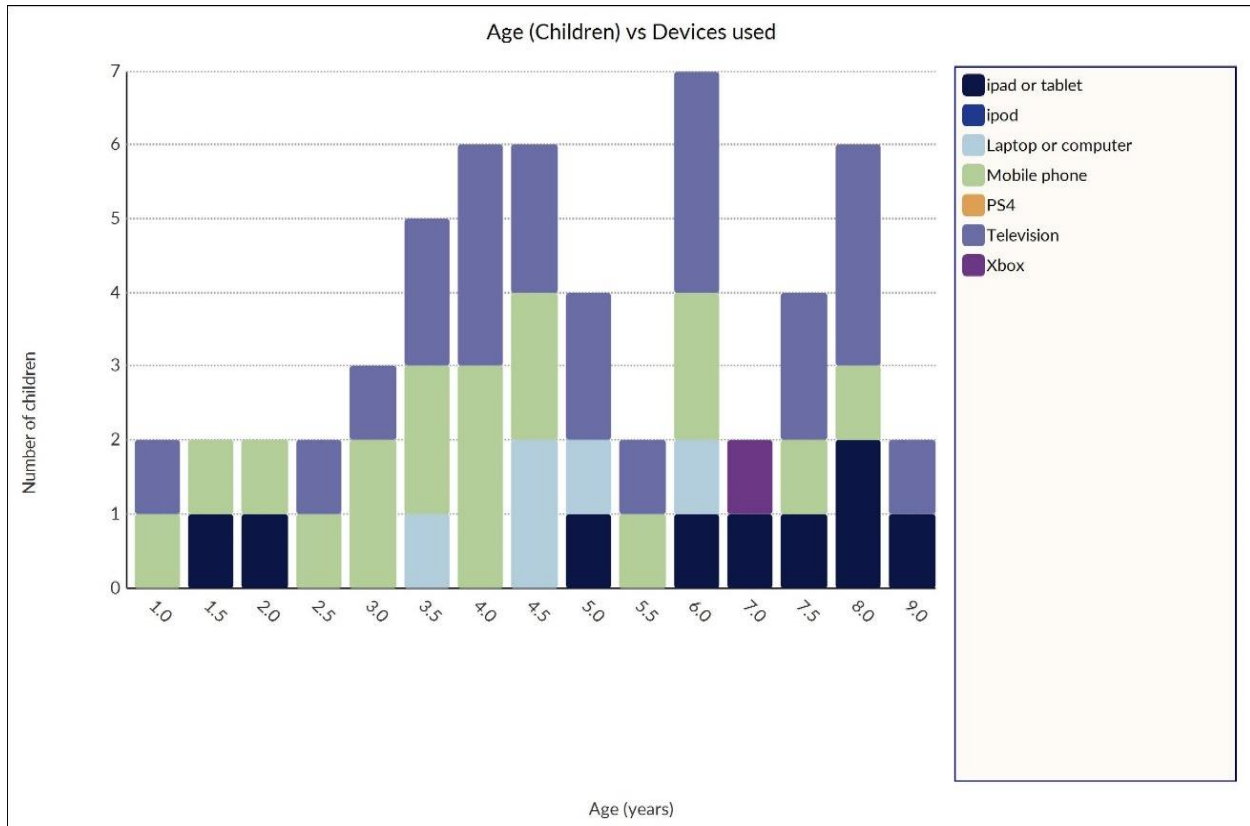
4.2.1.2 Accessed Content

With reference to figure 10, most of the Pakistani children were found to be interested in entertainment videos while some of them were inclined towards video games and few were involved with learning-based content and fun activities. Other content like browsing, music, social media and online shopping had no consumer among children aged from 0 – 9 years.
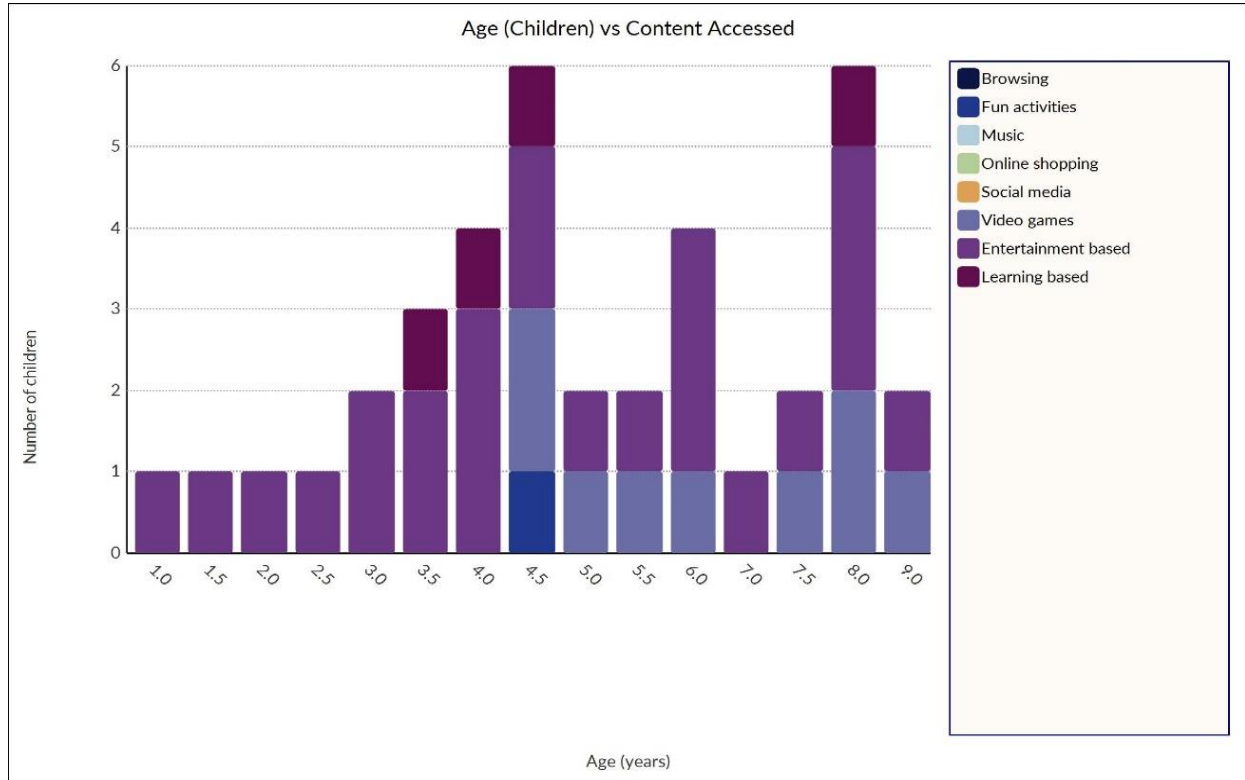
Figure 10. Media Utilization by Children

4.2.2 Trends among Adolescents

Technology trends of Pakistani adolescents are explored in this section on the basis of their daily utilization, most frequently used devices and commonly accessed content and number of hours spent on electronic devices.

4.2.2.1 Popular Electronic Devices

In comparison to children, mobile phone is the most common in adolescents followed by laptop and computer. Some adolescents also preferred television. Tablet, iPad, PlayStation, Xbox and iPod were noticed to be rarely used.

Exact details of device usage among Pakistani adolescents are exhibited in figure 11.
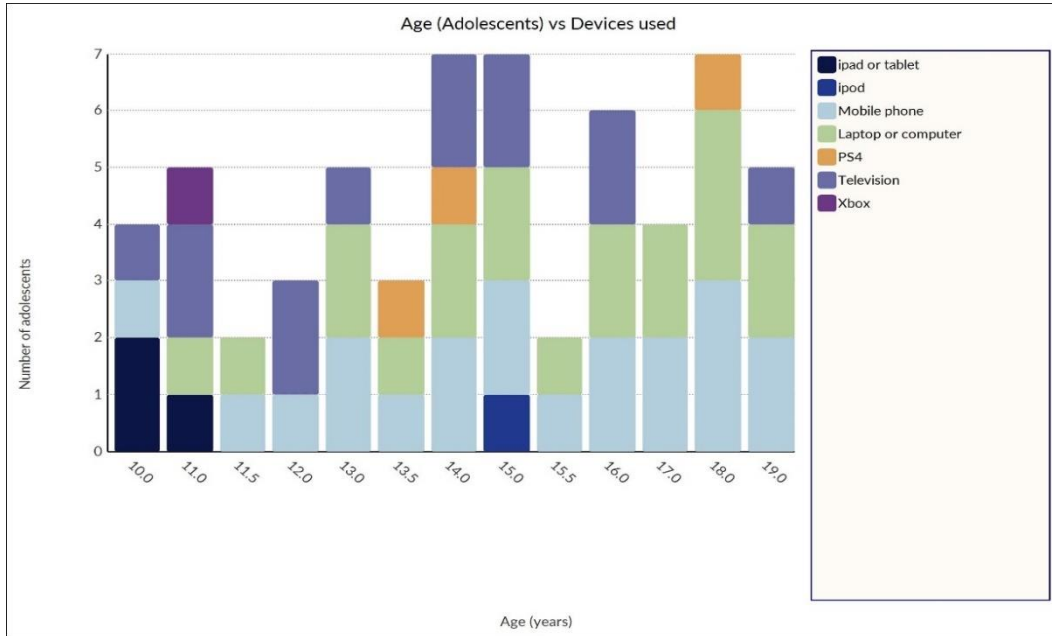
Figure 11. Utilization of Devices by Adolescents

4.2.2.2 Accessed Content

With reference to figure 12, most of the Pakistani adolescents were found to be interested in entertainment videos (as was noticed among children) and games while some of the teenagers (ranging between 15 – 19 years) were inclined towards social media and few were attracted to learning-based content and browsing.
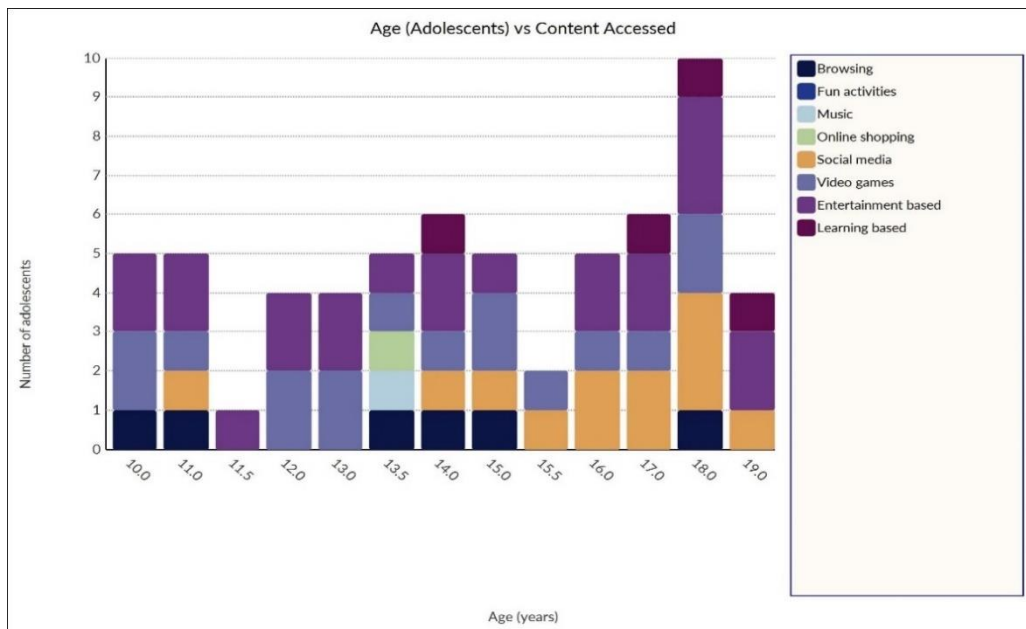
Figure 12. Media Utilization by Adolescents

4.2.3 Device Usage Trends

This part presents collective usage of various devices by children and adolescents. Mobile phone was discovered as the most commonly used device among both age groups of children (figure 13).
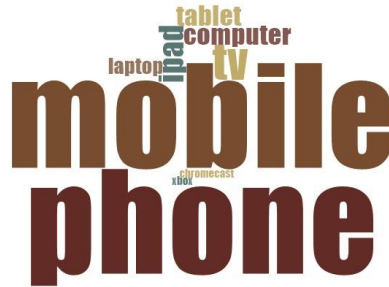
Figure 13. Most Commonly Used Electronic Devices

Whereas a variation was noticed based on the most frequently used device. All teenagers were fond of using mobile phones along with some little ones of 2 to 5 years old. Frequency of using iPad, tablet and television was high in children while adolescents often used laptop, computer and Xbox (figure 14).

Figure 14. Most Frequent Devices

4.2.4 Content Accessing Trends

This part presents collective usage of various media by children and adolescents. Games, videos, cartoons and movies were the most commonly accessed media among both age groups of children (figure 15). Entertainment videos and games were most commonly used media among children of all ages while some adolescents preferred social media and browsing (figure 16).

Figure 15. Most Commonly Accessed Media

Figure 16. Most Commonly Accessed Media
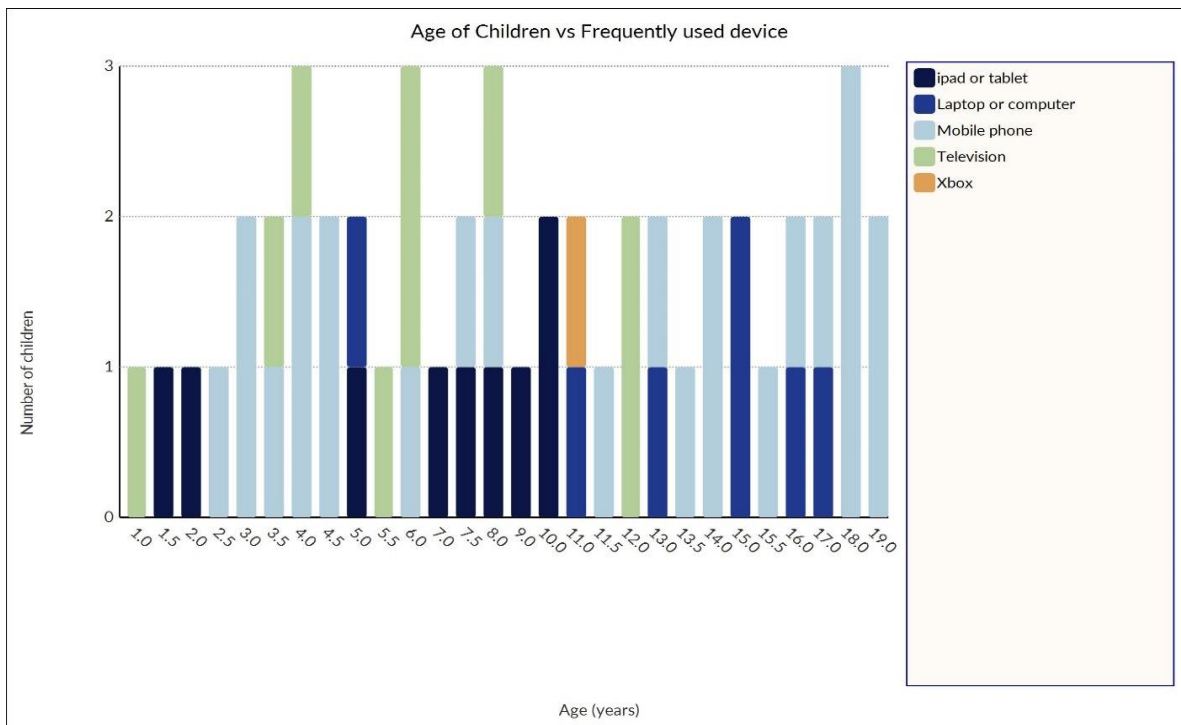
4.2.5 Technology Consumption Time

As shown in the previous section, Pakistani children and adolescents commonly use technology. A point of concern here is the amount of time they spent with technology. Some children's usage time is 3 to 5 hours a day (figure 17) which is quite high for this age group. But on the positive side, mostly children consume technology for maximum 2 hours, and no one used for more than more than 5 hours.
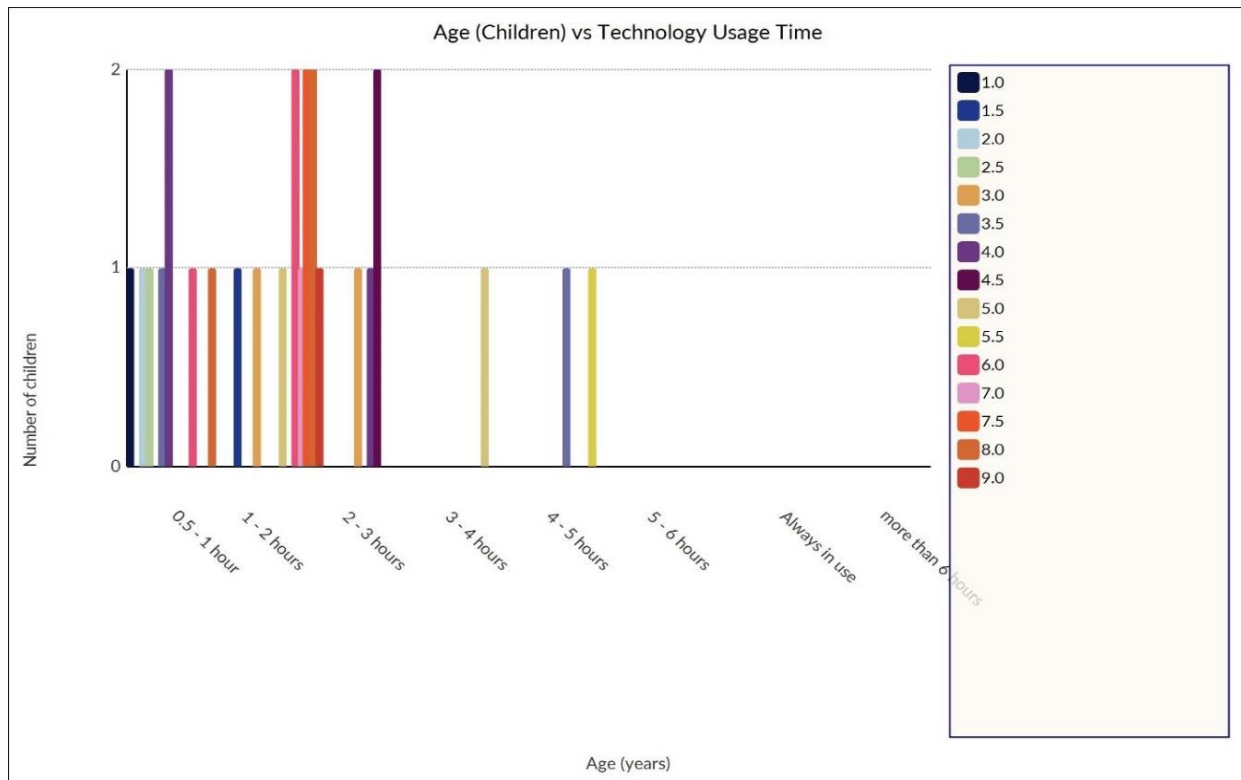
Figure 17. Technology Consumption of Children

However, situation is quite alarming for adolescents regarding technology consumption as some of them are always using it and one spent more than 6 hours daily. Another unpleasant fact discovered here is the average utilization by adolescents which was found to be 3 to 5 hours every day (figure 18).
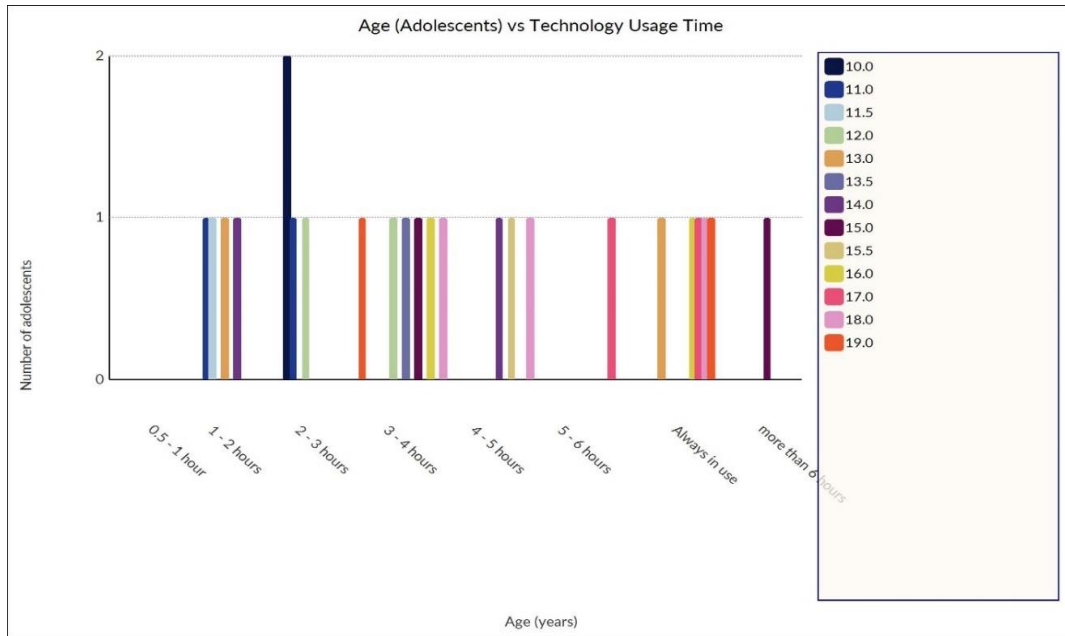
Figure 18. Technology Consumption of Adolescents

4.3 Physical Activities Time

We also examined amount of time Pakistani children and adolescents spent in physical activities which were observed to be very encouraging as there was only one child who gave no time to such activities while some even spared more than 5 hours every day. Majority of children spent around 4 hours regularly.

Figure 19. Physical Activities Time of Children

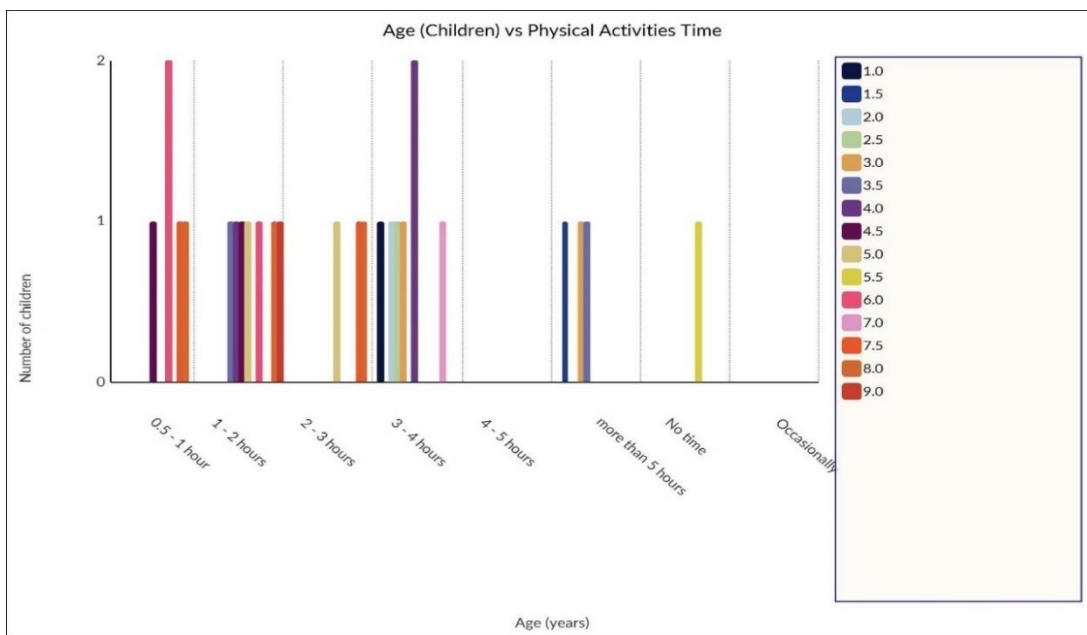As compared to children's time of physical activities, it was revealed that adolescents were less inclined towards physical activities with some teenagers who occasionally spare time and few of them who had no time at all for such activities. Another matter of concern was there was no adolescent who spent more than 3 hours in physical activities and most of them were only able to give 0.5 to 2 hours on regular basis.
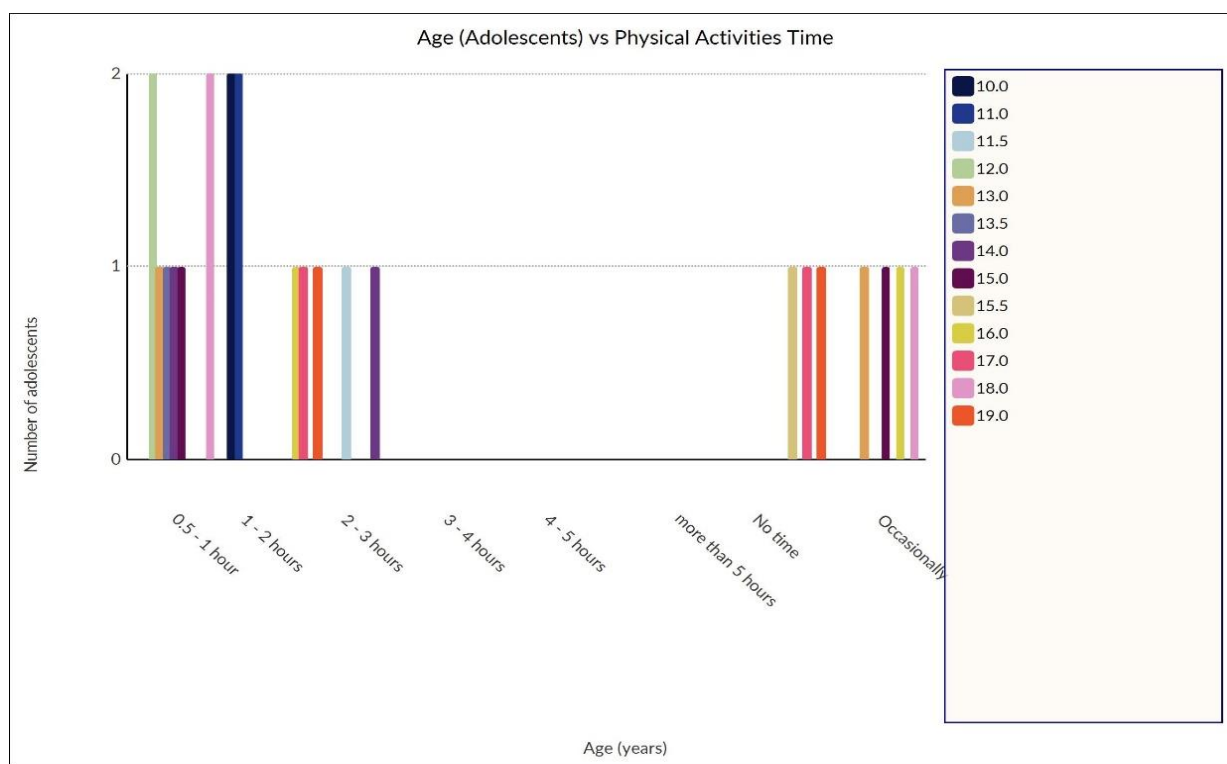
Figure 20. Physical Activities Time of Adolescents

4.4 Technological Impact

Technology utilization has a direct influence on children, i.e. having greater amount of technology time has a significant impact. These effects may be negative, positive or both, depending on various parameters including type of content accessed, the purpose of use and amount of spent time. So, this section' serves two purposes: one is to explore the type of impact (whether positive or negative) of various devices and content on Pakistani children and adolescents, and secondly to examine the nature of impact.

4.4.1 Impact of Devices

Electronic devices can prove to be beneficial as well as harmful. Constructive use of devices can deliver productive outcomes in numerous ways. On the other hand, they may bring worsening in lives in multiple forms. Here we have presented benefits and adverse effects of devices from parents' perspectives.

4.4.1.1 Positive Impact

In the light of parents' viewpoint, mobile phone, laptop and computer were identified as most advantageous devices by making children and adolescents more informed and boost their confidence level, enhance learning, creativity and knowledge. Other useful devices in this regard were discovered as television, PlayStation, iPad and tablet. Remaining devices like iPod and Xbox had no positive significance as described by parents.

Figure 21. Positive Impact of Devices

4.4.1.2 Negative Impact

Severity of devices is much greater in comparison to their usefulness. According to parents, among various technologies, television, mobile phone, laptop and computer were revealed as most damaging devices in terms of weak family bonding, short

tempered, less social and irritable to name few of them. Use of remaining devices were also found to be harmful in various aspects as presented in figures 22 (a and b).

Figure 22a. Negative Impact of Devices

Figure 22b. Negative Impact of Devices

4.4.2 Impact of Content

In a similar manner as devices, content can prove to be beneficial as well as harmful. Accessing useful content can deliver productive outcomes in numerous ways. On the other hand, they may bring deterioration in lives in multiple forms. Here we have presented benefits and adverse effects of content from parents' perspectives.

4.4.2.1 Positive Impact

In the light of parents' viewpoint, entertainment videos and content were identified as most advantageous media as their use make children and adolescents more informed and boost their confidence level, enhance learning, creativity and knowledge. Other beneficial media in this regard were discovered as learning-based videos, online shopping, music and browsing.
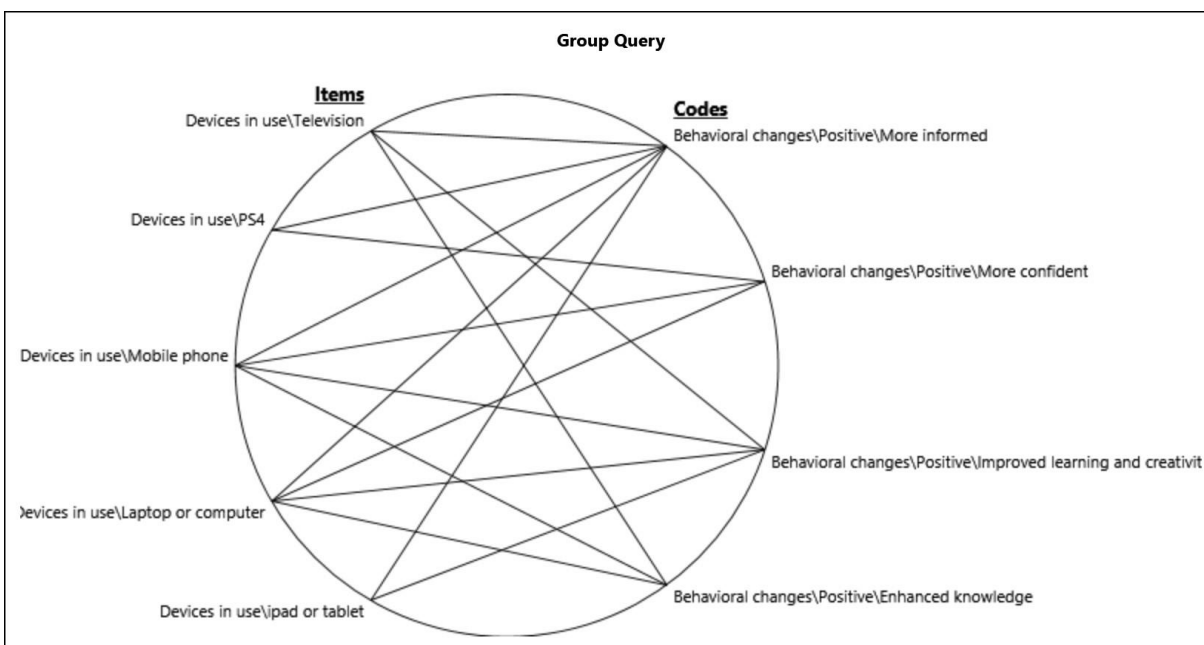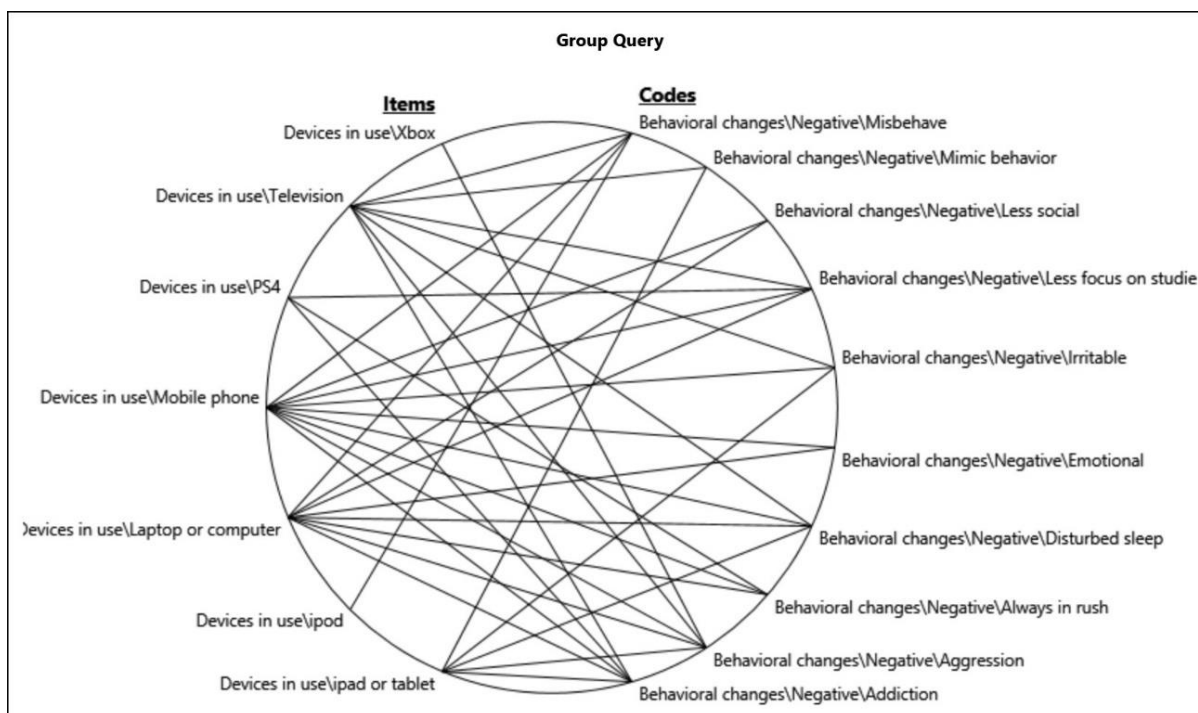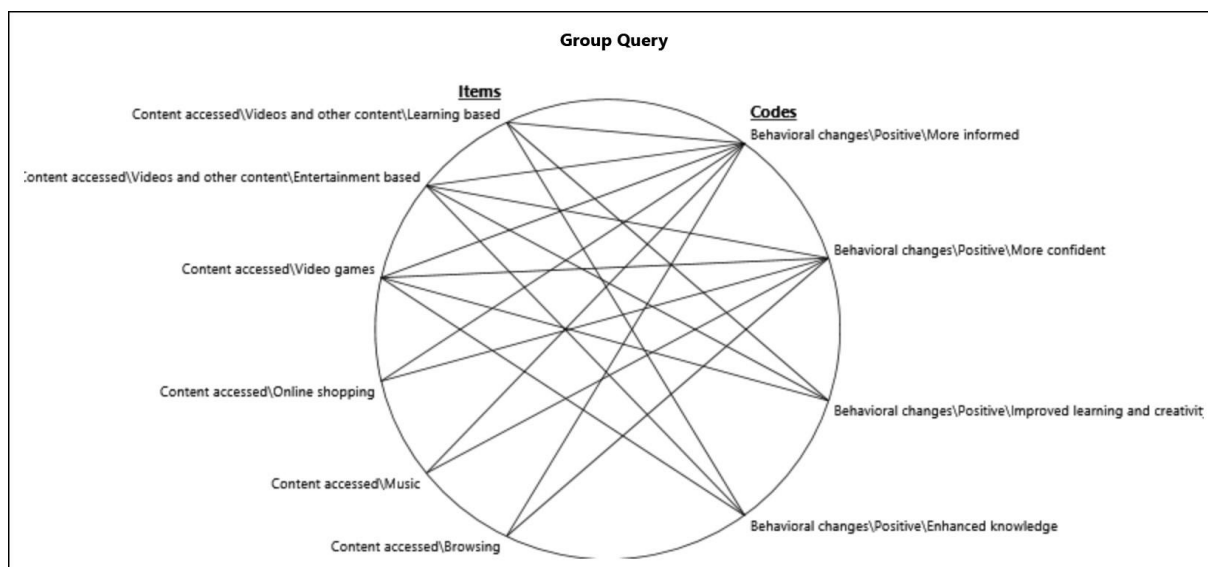
Figure 23. Positive Impact of Content

4.4.2.2 Negative Impact

Severity of digital media is much greater in comparison to their usefulness. According to parents, among various type of content accessed, entertainment videos, games and social media were revealed as most damaging media in terms of misbehaving, mimicking others and emotional to name few of them. Access to other media were also found to be harmful in various aspects as presented in figures 24 (a and b).
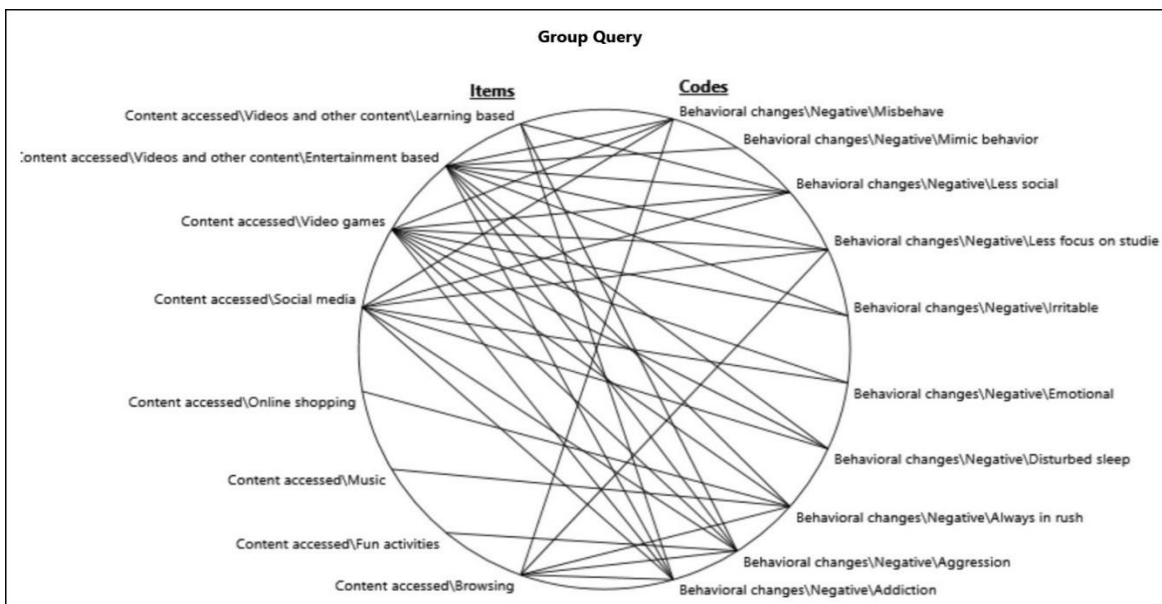
Figure 24a. Negative Impact of Content

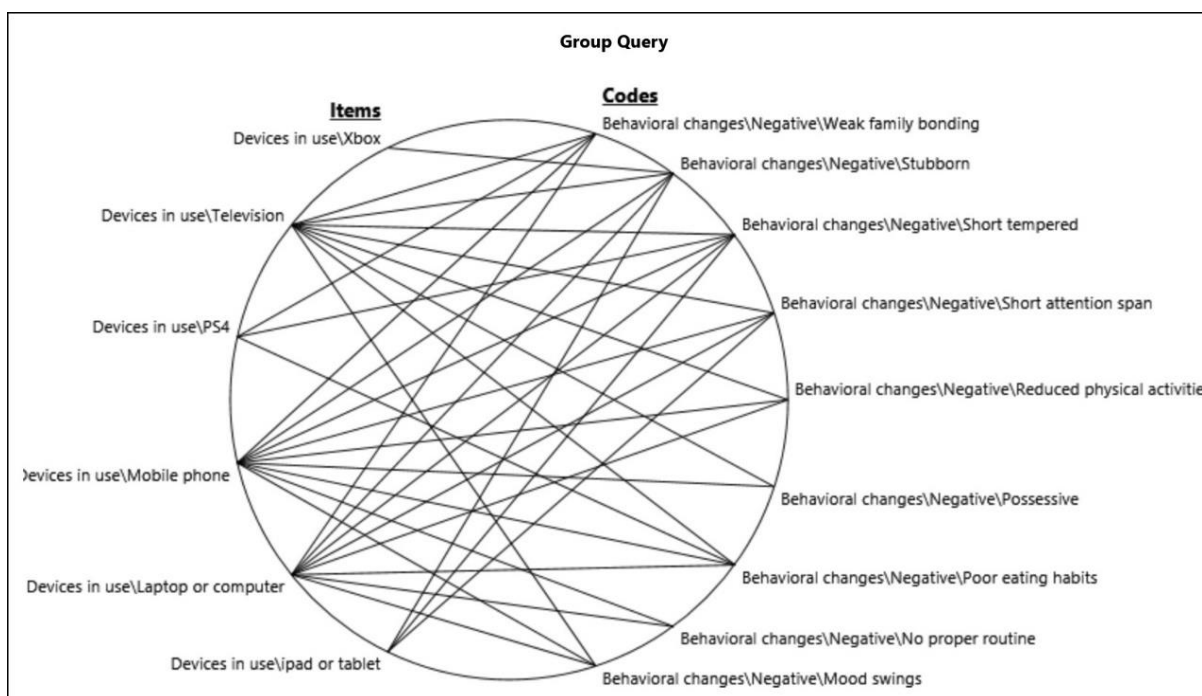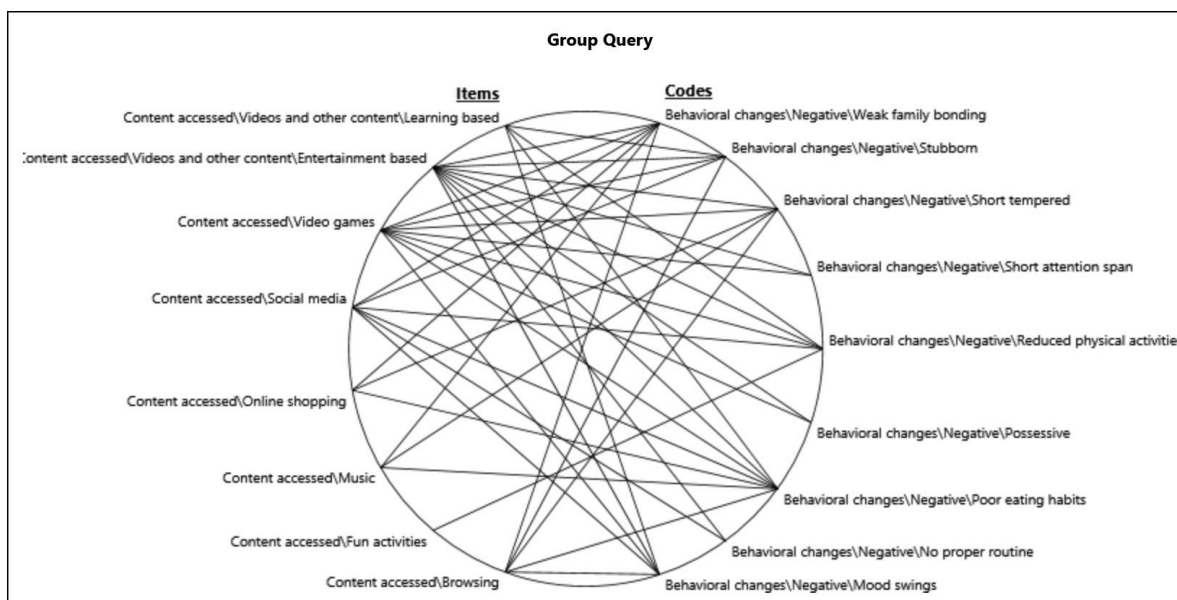Figure 24b. Negative Impact of Content

Hence, it is quite evident (from figures 22 and 24) that technology is causing serious harmfulness on children and adolescents of Pakistan. The most common adverse effects on children were aggressive and irritable behaviors (figure 25). Among adolescents, the negative impacts were mostly in the form of stubbornness, possessiveness, misbehaving mood swings, aggressiveness and less focus on studies (figure 26).
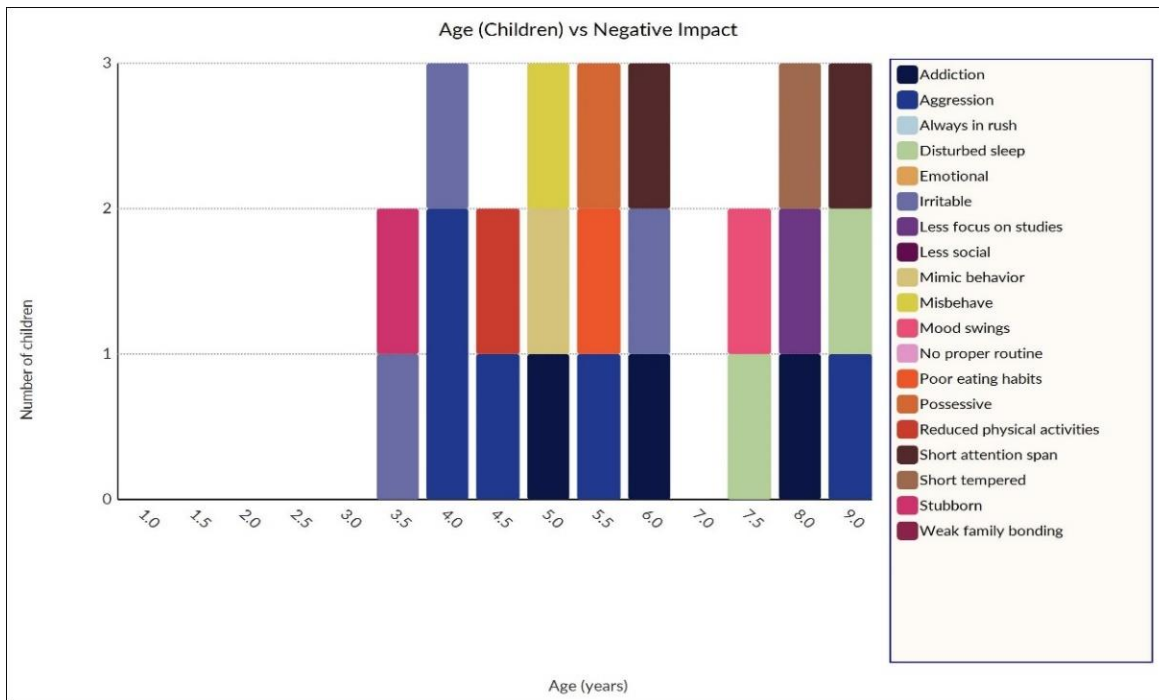
Figure 25. Negative Outcomes of Technology (Children)
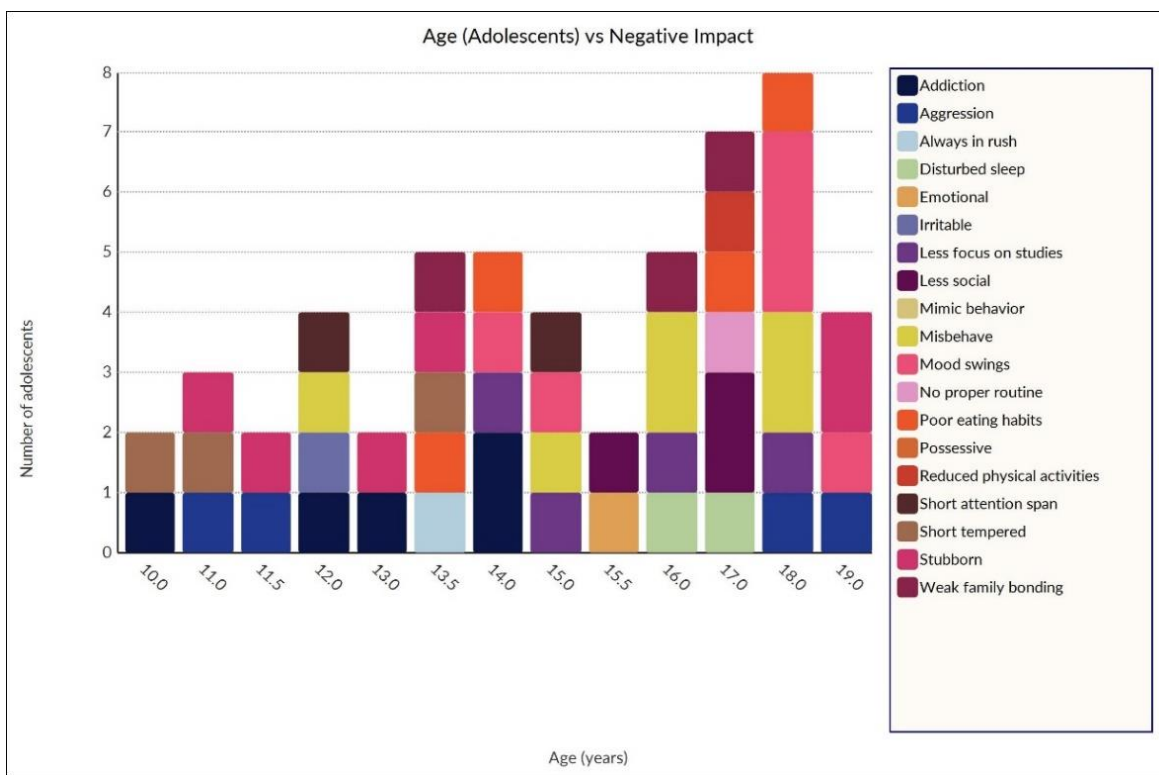
Figure 26. Negative Outcomes of Technology (Adolescents)

4.5   Most Affected Group

Overall negative effects on Pakistani children and adolescents are depicted in figure 27 which shows that both age groups are significantly suffering from technology. Children faced harmfulness mostly through aggressive and irritable behaviors and addiction. In other group, most of the adolescents who belonged to early years suffered due to aggression and addiction while other teenagers faced issues like mood swings, less focused towards studies and stubbornness. In overall summary, aggression and stubbornness were most commonly exhibited by both age groups.
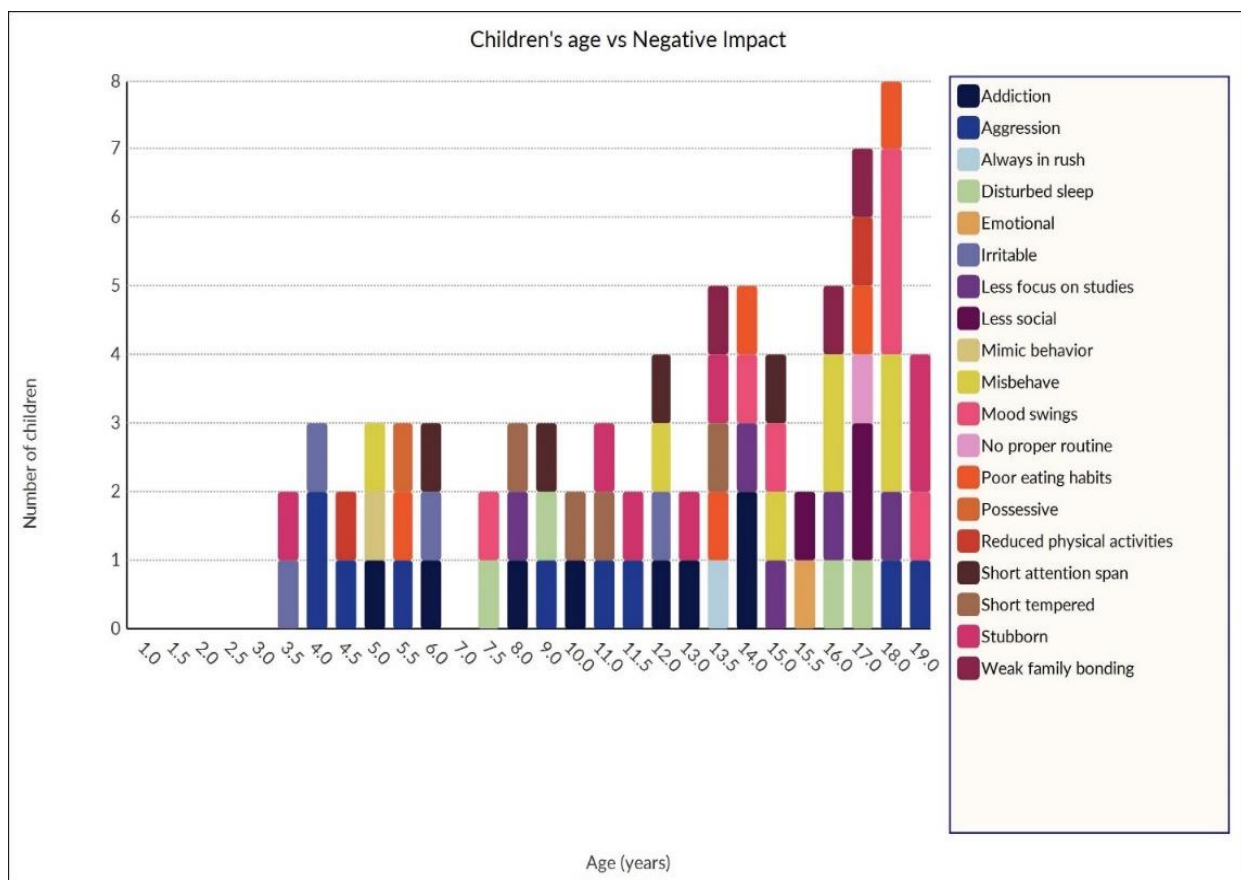
Figure 27. An Overview of Negative Behaviors

4.6   Findings

Our findings are briefly presented in table 2.

	Frequently used Device	Frequently used Content	Most influenced Age group	Most influential Device	Most influential Content
Children	Mobile phone	Entertainment videos, (cartoons)	4-9 years old (excluding 7 years old)	Mobile phone	Entertainment videos, Video games
Adolescents	Mobile phone	Entertainment videos (movies)	18 years old	Mobile phone	Entertainment videos, Video games

Table 2. Main Findings

4.6.1 Technology Consumption in Association with Physical Activities

In the previous sections we explored technology usage time and also examined time spent by Pakistani children and adolescents in physical activities. The purpose of analyzing this data is to find the relationship between technology consumption and physical activities. With reference to figures 17 and 19, it was observed that technology usage time and physical activities time of children are inversely related. Those who spare much amount of time (4-5 hours) for technology gave no time to physical activities. While those with 3 to 4 hours of physical activities had less time for technology (0.5 to 1 hour).

In case of adolescents, similar kind of findings were revealed (from figures 18 and 20). Those teenagers who were always using technology gave no time to physical activities whereas those using technology for 4 to 6 hours or even more time occasionally spared time for physical activities.

4.6.2 Technology Awareness among Parents

In consideration of excessive technology utilization by children and adolescents and its impact on them, we figured out awareness level of parents as children are mostly under

their observation. It was identified that irrespective of gender, most of the parents have awareness about the benefits and harmfulness of technology (figure 28).
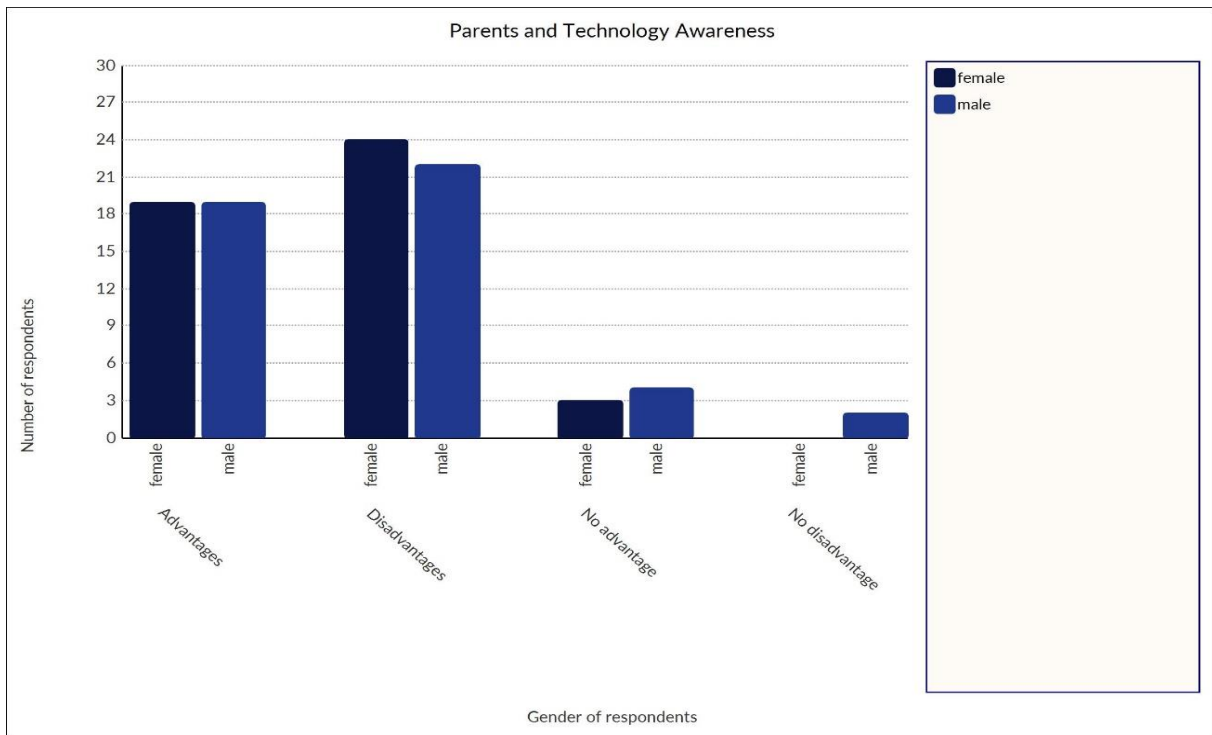
Figure 28. Technology Awareness Among Parents

Another point of interest here in relevance to parental awareness is the relationship between their monthly income and technology utilization. In other words, awareness of parents can be determined by the fact that since they are well aware of serious consequences of technology, they do not provide numerous electronic devices to their children, irrespective of their monthly income. It is quite evident from figure 29 that monthly incomes range from PKR 45K to 500K but children with the greatest number of devices belonged to families with total earnings of PKR 100 K to 200K. Complete details of technology usage along with monthly incomes of families are depicted in figure 29.
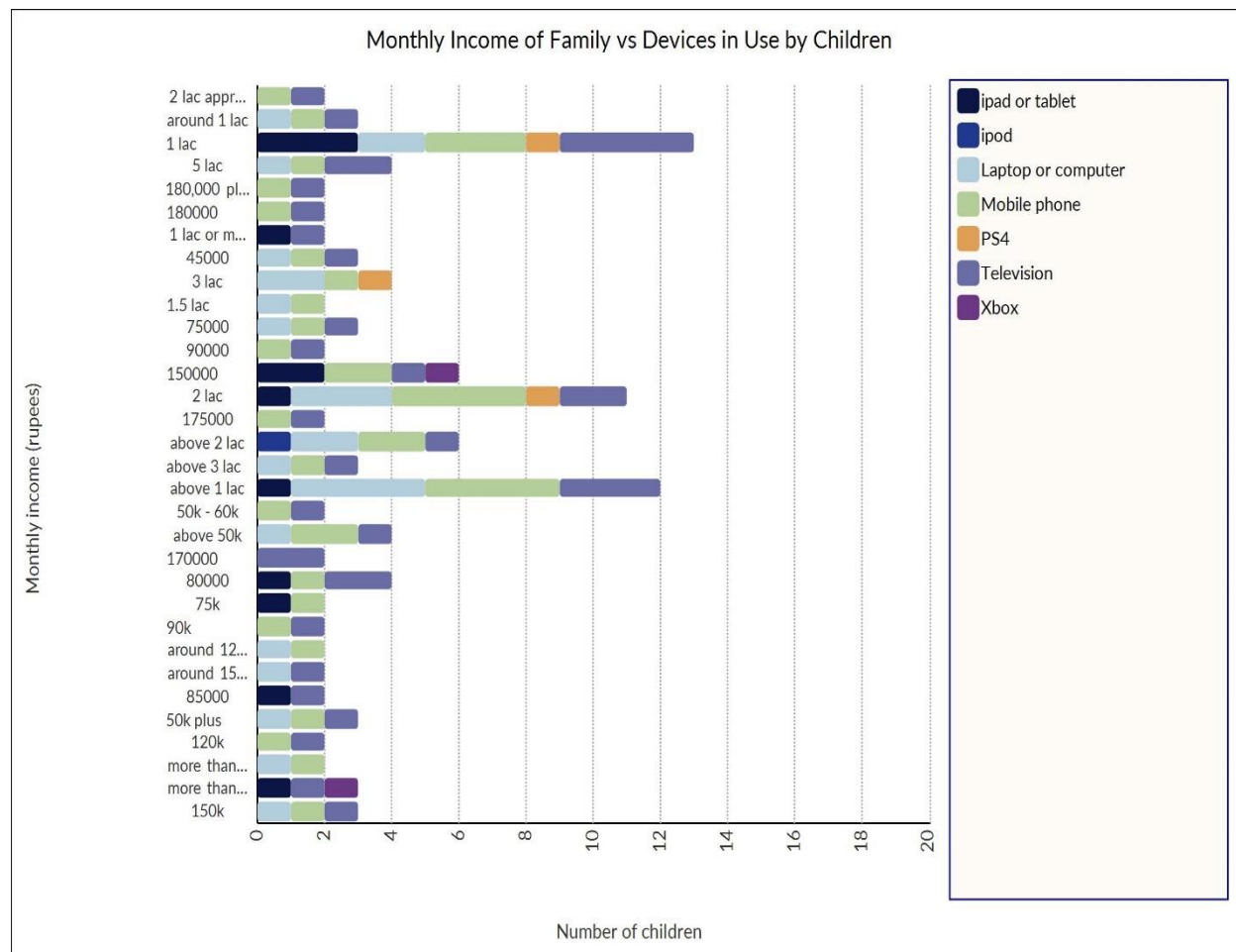
Figure 29. Relationship Between Monthly Income and Device Usage

As parents are well aware of the severity of technology, therefore in this regard, most of the parents showed keen interest in taking necessary measures to minimize technology consumption by their children, and secondly, to mitigate severe effects of technology on them. For this purpose, most of them followed time restriction rule, i.e. allowing use of technology for a certain time duration. Some parents also believed that advising their children (particularly adolescents) about harmfulness would contribute in controlling them. It was also reported by some parents that children technology exposure can be controlled by monitoring their activities. Other parents relied on rewarding for less and punishment for more use, engaging their children in other activities, strict control, disallowing them to use small screen and let them use technology only for constructive purposes. These details are presented in figure 30.
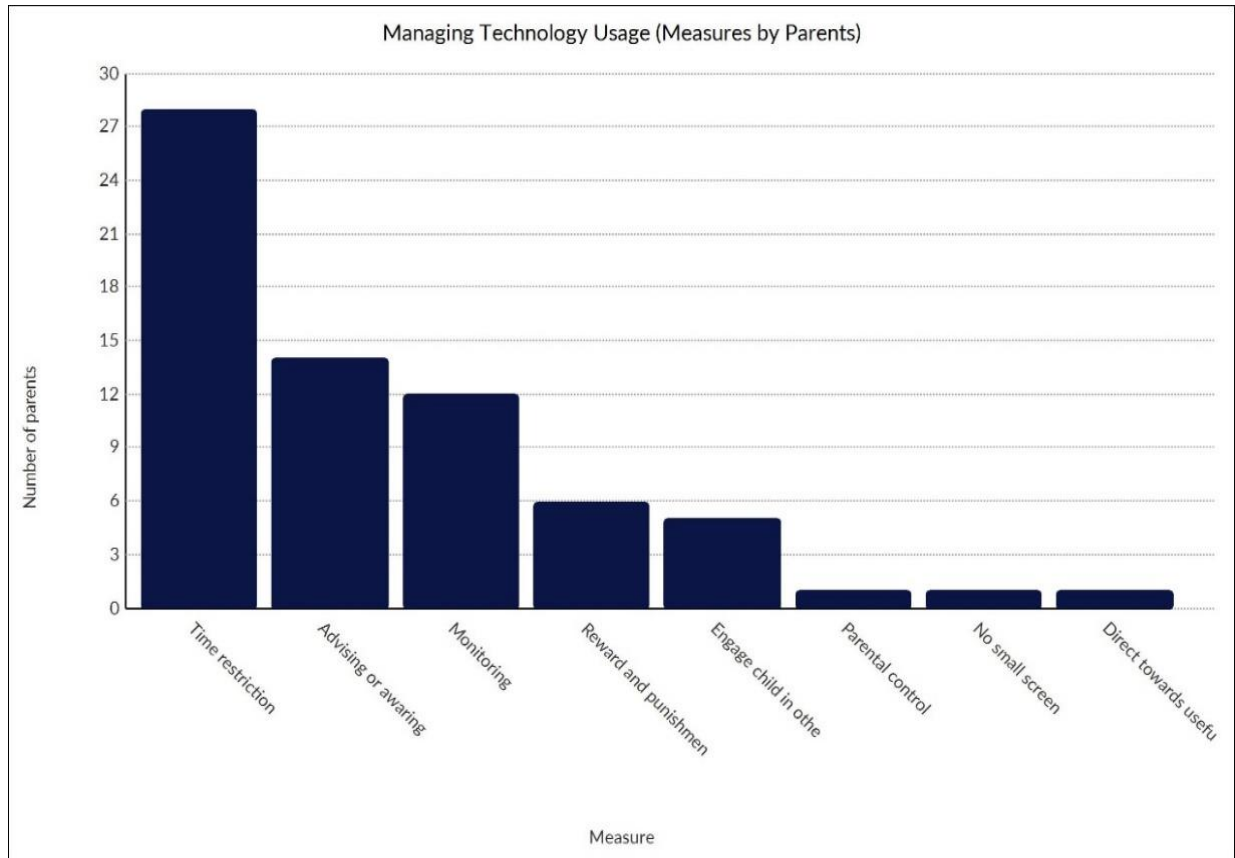
Figure 30. Parental Approaches for Technology Management

4.6.3   Technological Shortcomings – Parents' Perspective

- In certain kids Apps like YouTube Kids, filters are not effectively implemented as sometimes inappropriate content appears. It also blocks some safe videos when specific age group of children is mentioned.

- Many kids Apps work with internet only. As kids are using Apps with internet access, some inappropriate advertisements also appear.

- Blue light from LED screens of computers and other portable devices keeps children alert and disturbs their sleep cycle.

- Family Link App by Google which facilitates parents in restricting children technology exposure also has some weaknesses. When screen time is set, it sometimes does not lock the device when the time limit exceeds.

4.6.4 Technological Interventions – Parents' Perspective

In view of the deterioration and damage caused by technology on Pakistani children and adolescents, parents provided various ideas for preventing harmfulness to their children in future. According to parents, strict parental control, content restriction, provision of learning-based content, prohibition of device for children under a specific age, disallowing social media and letting them access media through child profile may facilitate parents in future.
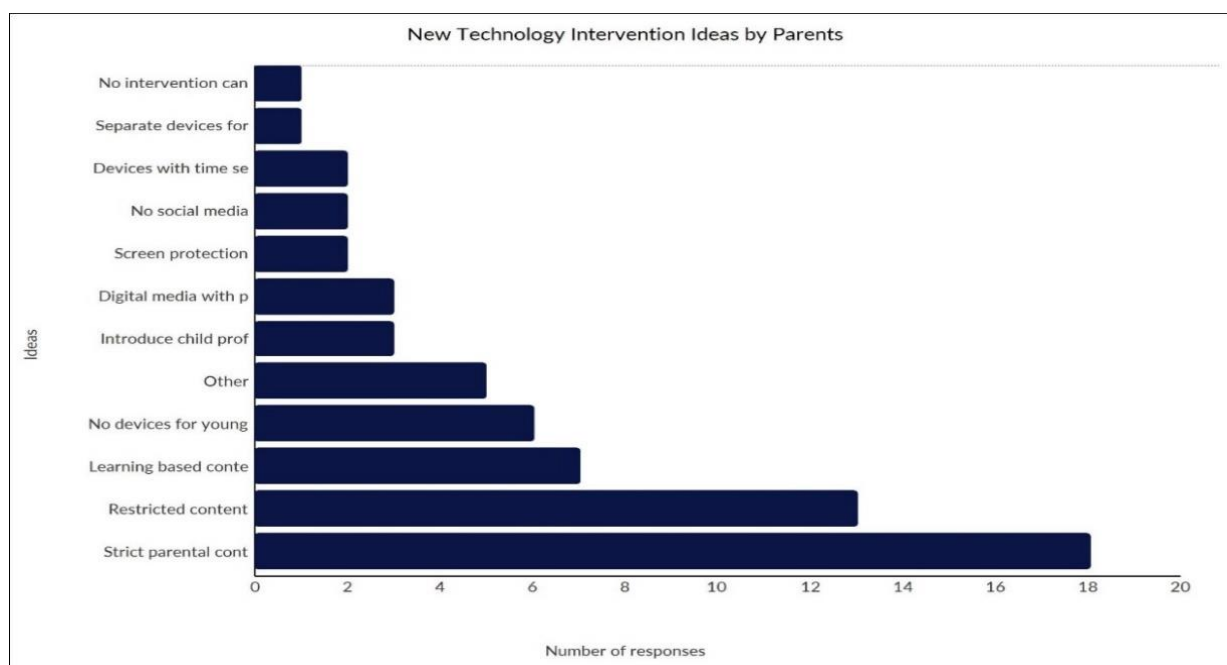
Figure 31. Parents' Perspectives of Technological Interventions

4.6.5 Cross – Cultural Comparison

This section provides cross-cultural comparison between some developing and developed countries to find how technology trends adopted by children and adolescents belonging to developing countries like Pakistan, Turkey, Mexico, Brazil and India vary in comparison to developed countries including Norway, America, England, Australia and Germany. The data for comparison purpose was obtained through literature review and following studies contributed for developing countries [71] [72] [67] . Data for developed countries was gathered with the help of [73] [74] [75] [67] [76].

Among children of developing countries, Mexico and Brazil top the chart with Mexican children were found to be using mobile phones and video for almost 4.5 hours a day and Brazilian children were more inclined towards laptop, mobile phones and games with 3.5 hours of each technology on daily basis. Pakistan can be seen (in figure 32) on the lower side close to Turkish children where maximum time is spent by Pakistani children in video watching which is 2 hours while average laptop time is 0.

Indian children have a screen time of 2.5 hours, led by Brazilian and Mexican children (3 hours each). In comparison to these countries, screen time of Pakistani children is much satisfactory with 1.5 hours of screen time daily.
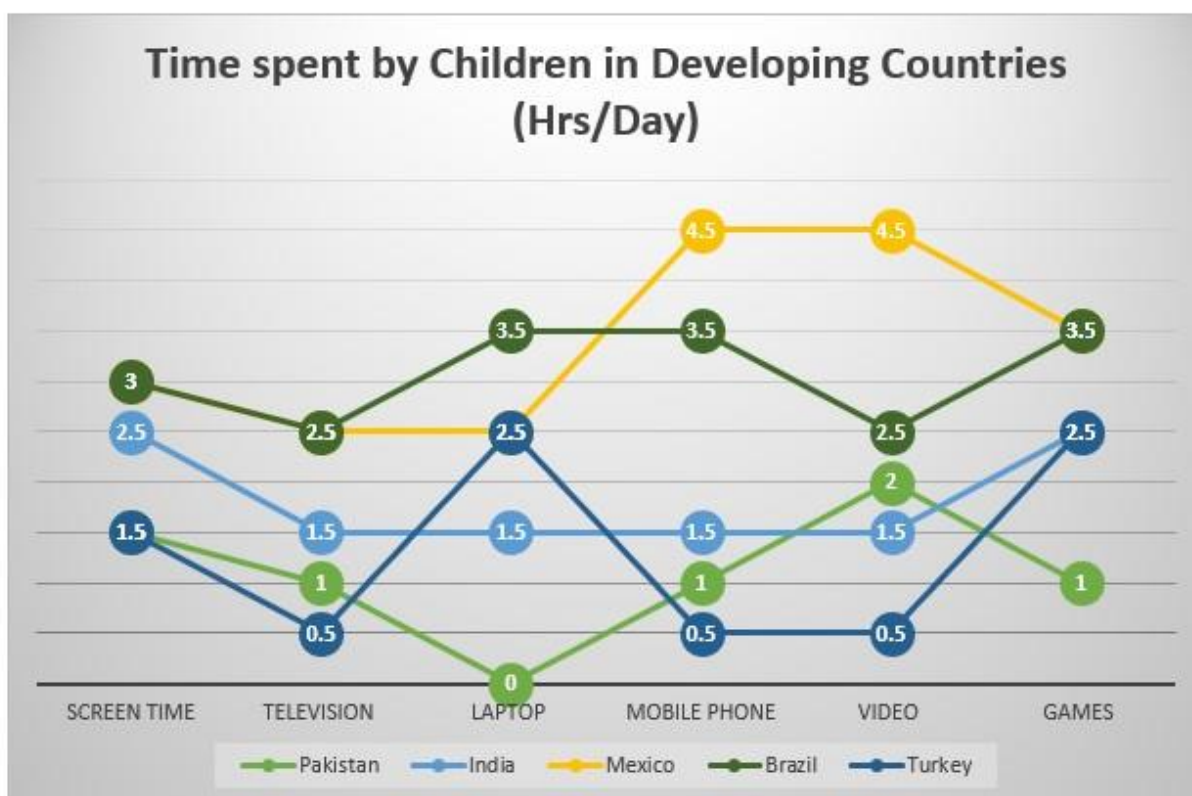
Figure 32. Children's Technology Consumption in Developing Countries

On the other side, screen time of Pakistani adolescents is 3.5 hours every day which is second highest (i.e. 3.5 hours equivalent to time of Turkish adolescents) after Brazil (6.5 hours). In comparison to children, adolescents of Pakistan consume technology for greater time, specifically for gaming and mobile phones (3 hours each). But still they are behind

Brazilian, Mexican and Turkish adolescents. Overall, Brazilian adolescents have the maximum technology time among all other developing countries under study. Complete details are shown below in figure 33.
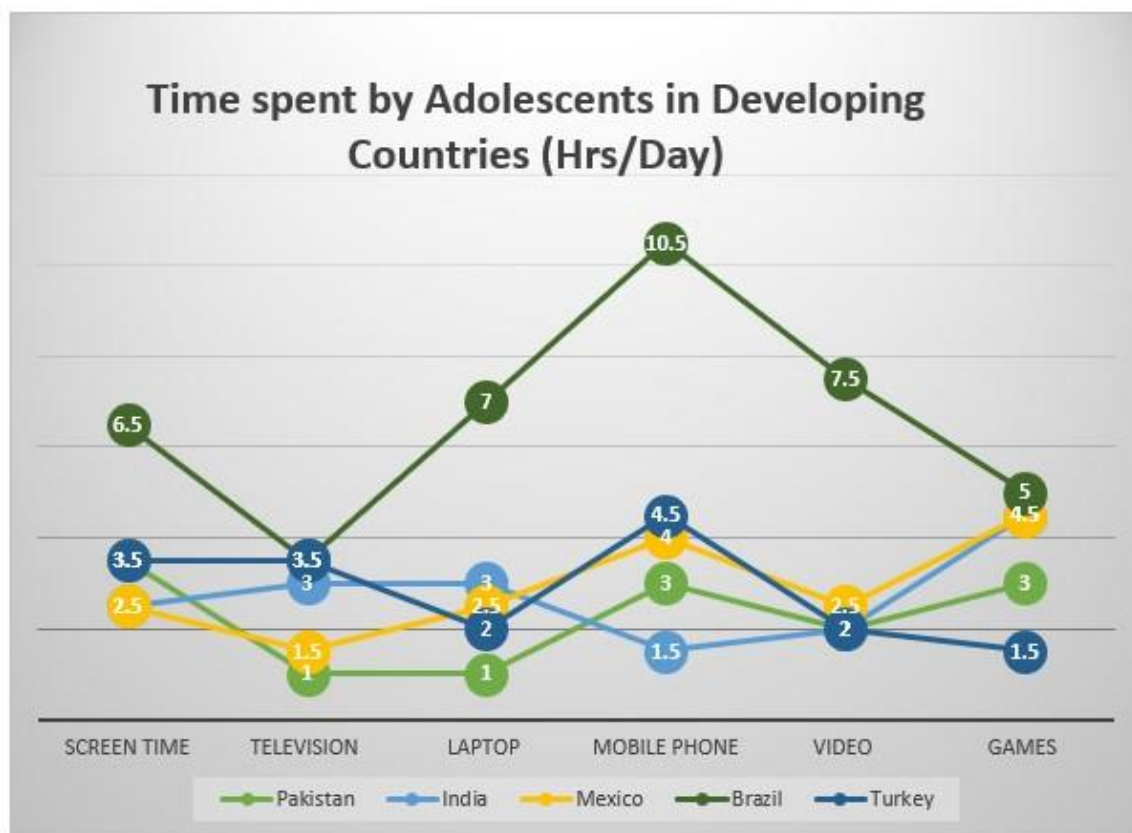
Figure 33. Adolescents' Technology Consumption in Developing Countries

Among developed countries, Norwegian and British children had high screen time with 5.5 and 5 hours on daily basis. Among this group, only Australia managed to control screen time of children with 3 hours. Germany and America have also controlled children to some extent with average screen time of 3.5 hours in both countries (figure 34).

However, adolescents of developed countries are facing alarming situation with lowest screen time of 5 hours (followed in Australia) while maximum time of 9 hours in Norway. The only acceptable factor is less usage of television by adolescents of developed countries. Other technologies like laptop, videos and games are used in these countries for 1.5 to 5.5 hours regularly. Mobile phones have the highest usage time of 3.5 to 5.5 hours per day (figure 35).
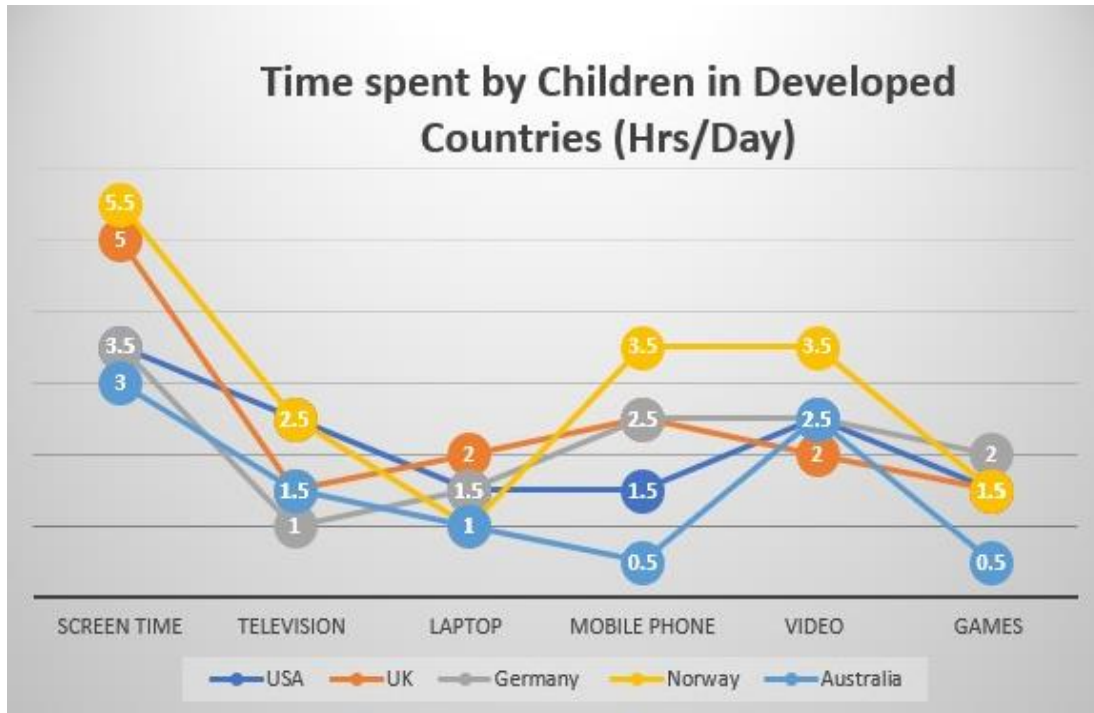
Figure 34. Children's Technology Consumption in Developed Countries
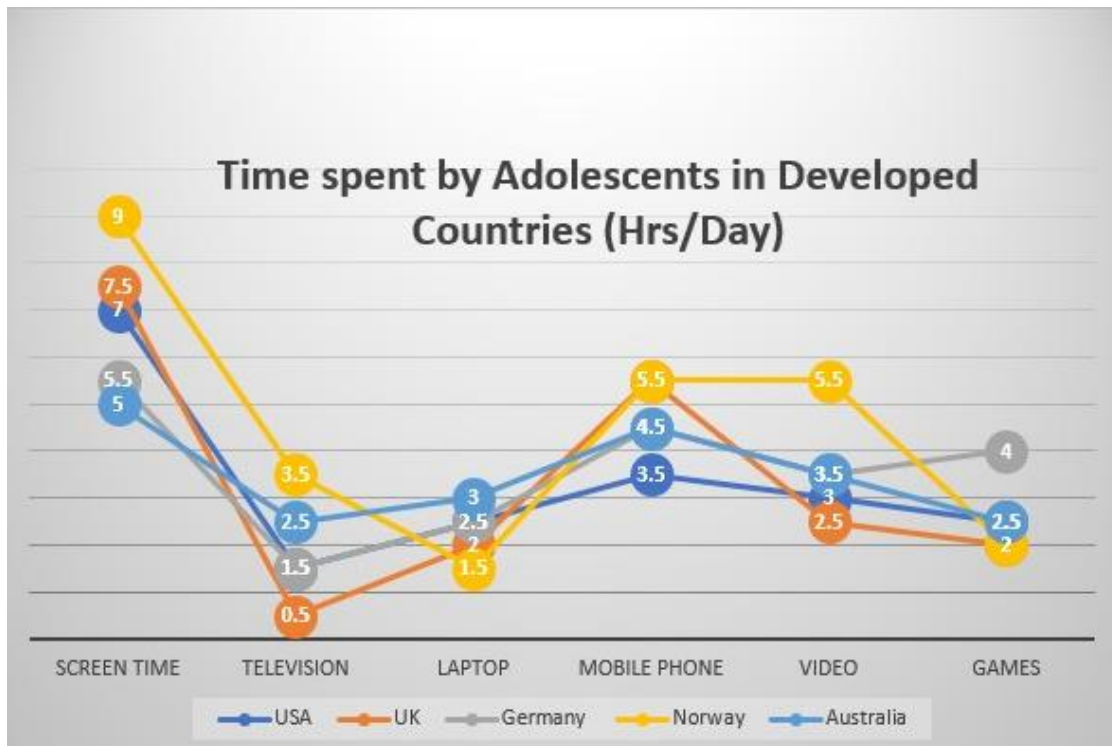
Figure 35. Adolescents' Technology Consumption in Developed Countries

In summary, we can conclude that overall screen time is much higher in developed countries among children and adolescents in comparison to those of developing countries. In children, television usage is almost similar in both categories of countries. However, consumption of other technologies such as laptop, mobile phone, videos and games is higher in children of developing countries.

Similarly, screen time among adolescents of developed countries is greater than those belonged to developing countries. Television utilization and gaming are almost similar in adolescents of both groups of countries. Time spent with other technologies including laptop, mobile phones and video watching are greater in adolescents of developing countries than those of developed countries.

Therefore, from findings, it can be determined that technology consumption is not dependent on economic condition of a country as other than overall screen time, use of various technologies is more common in children and adolescents of developing countries.

CHAPTER 5

CONCLUSION

5.1 Conclusion

Research findings reveal that technology trends cultivated by Pakistani children and adolescents are quite disturbing. According to our analysis, using technology for 1 to 3 hours every day is a common practice by most of them while some adolescents spend even more than 6 hours per day. On the darker side, some of them occasionally involve in physical activities, a few spares some time, whereas other adolescents have no time for physical activities on daily basis.

Based on our findings, it is found that technology supports youth in their learning, information retrieval and knowledge enhancement in addition to utilization of different technologies for entertainment purpose. Despite of having numerous benefits, it is also evident that in comparison to benefits offered by various technologies, their associated harmfulness is more obvious. These detrimental effects are reflected in children and adolescents by influencing their health and behaviors. Displaying of disturbed sleep patterns and poor eating habits by children consequently impact their health. In case of behavioral concerns, personal behavior of a child is affected in the form of possessiveness, less focused towards studies, short attention span, addiction, mood swings, short tempered, having less interest in physical activities and stubbornness. On the other side, social behaviors are

undermined by showing less socialism, aggressiveness, irritability, having weak family bonding, mimicking and misbehaving with others and always in a rush.

Since the findings are based on data obtained from parents, it is quite alarming to find out that despite of being aware about the severity of technology, parents are less concerned regarding the increased use of technology by their children. Subsequently, they have not taken adequate measures to control the young ones. Seemingly, since a child stays at home mostly, hence parents can contribute substantially by developing such effective strategies through which harmfulness of technology can be lessened.

5.2 Future Recommendations

In view of mounting adverse impact of technology on Pakistani children and adolescents, following factors can play a significant role:

1. Parental Role

As mentioned earlier, parents can make a considerable change in the lives of children, regarding technology usage with their effective input in following directions:

- **Technological Acquaintance**
  Parents can manage technological utilization by their children more efficiently only after having an in-depth understanding of positive and negative effects of different technologies. In this way deleterious consequences of technology can be minimized.

- **Awareness of Postural Risks**
  Parents should be aware of postural risks associated with the use of computers and tablets and modify home environment accordingly in order to avoid musculoskeletal discomfort.

- **Establishment of Best Practices**
  Children are greatly inspired by their parents and look upon them keenly. Hence, appropriate consumption of technology and following a proper routine by parents like having less technology time, utilizing media in constructive manner and making

physical activities a mandatory part of their daily routines can result in a positive outcome in context of less technology utilization by children.

- **Strict Time Monitoring**

  Continuous and vigilant monitoring of children's screen time can also help parents in preventing damage caused by technologies. In view of benefits and harmfulness, parents can decide technology consumption time of their children and type of content they can access.

- **Co-viewing**

  Co-viewing by parents can help children in understanding onscreen content.

2. Technology Interventions

In the light of past research and parents' suggestions, this study presents some useful recommendations for engineers to consider while designing future technologies. Once implemented, they can certainly benefit caregivers in controlling and managing their children's technology consumption. These include:

- Electronic devices and media should provide the feature of child profile as offered by Netflix and YouTube, so that children may only be allowed to access content that is appropriate for their age.
- All devices must come up with a feature which enables parents to view the history of every activity their child has been engaged with.
- Parents must have a remote access to their children's devices from anywhere.
- An alarm mechanism can be introduced in devices such that whenever children try to access restricted content, an alarm generates in parents' devices.
- Develop active video games which may include AR (Augmented Reality) or geotracking to engage children in physical movements.
- There should be built-in applications to promote physical skills like Wii sports.
- High amount of technology time can be reduced without parents' intervention if device turns off automatically after the specified time duration set by them. In this way, time

monitoring will shift from parents to the electronic device.

- Using technology just for the sake of learning or making children physically active is also another interest of parents. Hence, they presented the idea of knowledge acquisition by children through technology by using such media which support physical interaction (e.g. Kinect) and blocking of all other kinds of content like social media.

- Excessive screen time significantly deteriorates children's health by effecting their eyes, brain and sleep patterns. Therefore, screens of all devices must be designed such that children can be protected from severity caused due to screen exposure either by reducing the use of blue light or design affordable blue light glasses.

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APPENDIX A

Consent Form

Title of the study: *Technological Trends and their Consequences on Children and Adolescents*

I confirm that I have read and understood the information about the project.

I confirm that I have had the opportunity to ask questions and the researcher has answered any questions about the study to my satisfaction.

I understand that my participation is voluntary and that I am free to withdraw from the project at any time, without having to give a reason and without any consequences.

I consent to interviews being recorded as part of the project.

I consent to use of the data in research, publications, sharing and archiving.

I agree to take part in the above study.

Date: _____   Signature: _____

APPENDIX B

Sociodemographic Questionnaire

Purpose: The information gathered through this questionnaire will be used as a part of a study on *Technological Trends and their Consequences on Children and Adolescents*. The research is a part of thesis for achieving MPhil degree.

Confidentiality: Please note that the information you provide will be kept confidential.

Demographic Profile:

1. Gender (parent)   2. Age _____
    a. Male ☐
    b. Female ☐

3. Gender (child)   4. Age _____
    c. Male ☐
    d. Female ☐

5. Education _____

6. Occupation of father _____

7. Occupation of mother _____

8. Monthly income of family _____

9. City _____

Thank you for your co-operation in completing this survey.

APPENDIX C

Interview Guide

1. How does your child engage with technology? Which is the most frequently used device?

2. Which content does your child access and use?

3. How much time does your child spend with digital technology daily?

4. How much time does your child spend in physical activities daily?

5. Is there any change in your child's behavior since using digital technology?

6. How do you manage your child's use of digital technology?

7. Do you think the use of digital technology is beneficial to your child? Please explain.

8. Do you think the use of digital technology is harmful to your child? Please explain.

9. How digital technology should be modified to reduce its harmful consequences?