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Abstract

The purpose of this research is to determine preschool students' usage profile of information and communication technology (ICT). To investigate children's use of ICT, a questionnaire was completed by the parents of 703 children, age 4-6. Frequency, percentage, mean and standard deviation were used to describe the interaction. In addition, inferential statistics were used to compare the demographic groups. The results of the study reveal that children live in a technologically rich environment. On a typical day, the mean number of minutes children watch TV is 115 and 28 minutes for computer usage. In parallel with this, children have many computer skills. According to gender, boys use computers more than girls. Furthermore, males have more computer skills than girls. In addition, the effect of parents' educational level and monthly income on children's ICT usage skills was determined. The results imply that children live in a technological rich environment and have basic skills to interact with ICT.

Introduction

Children's development levels and learning concepts are interrelated. Children can learn certain concepts in some developmental periods easily (Recchia, 1997). While children learn concepts and develop they interact with the environment. Today, one fundamental part of their environment is information and communication technologies (ICT). In preschool, which is the most important period of childhood development, technologically rich environments support preparation for a future world.

The use of ICT in early childhood education has been debated among early childhood educators since the 1980s. In the beginning, some educators (Cuffaro, 1984; Hohmann, 1998; Healey, 1998; Yelland, 1999; Haugland, 2000) argued that using ICT in early childhood education was harmful or ineffective. However, when research about ICT integration into early childhood education and the effects of ICT on child development (Hutinger&Johanson, 2000; Downes, 2002; Clemenets&Sarama, 2003; Lankshear&Knobel, 2003; Plowman & Stephen, 2005; Buckleitner, 2008; McPake, Plowman & Stephen, 2013) was conducted and reported, it became clear that ICT is a unique tool to support the development of preschool children. This can also result from the changes in technology since the 80s to present day.

Apart from the debate, there are many researchers focusing on ICT and preschool children, and integrating ICT to early childhood education (Hansen, 2009; Kucirkova, Messer, Seehy&Panadero, 2014; Marsh, Brooks, Hughes, Ritchie, Roberts & Wright, 2005; Rasanen, Salminen, Wilson, Aunio & Dehaene, 2009; Rideout, Vandewater, &Wartella,, 2003; Veenstra, van Geert & van der Meulen, 2010). In Turkey, there are some researchers of ICT in early childhood education (Akcay & Ozcebe, 2012; Akkoyunlu & Tugrul, 2002; Aktas-Arnas, 2005; Ayvaci & Devecioglu; 2010; Cankaya, 2012; Kabadayi, 2006; Kacar & Dogan, 2007; Kenanoglu & Kahyaoglu, 2011; Kol, 2006; Kol, 2012; Kucukoglu, 2013; Turkkent, 2012; Yuksel, 2011). However, there has been little research concerning children's usage characteristics of ICT in Turkey. It is aimed to fill this gap in Turkey through this research.

This research is concerned with determining kindergarten children's usage characteristics of ICT. Using or integrating ICT in early childhood education is in its infancy in Turkey. So, this research can provide useful information to kindergarten teachers, educators, parents and policy makers. The purpose of this research is to investigate preschool children's usage characteristics of ICT. To this aim, it is aimed to find the answers to the following questions: (1) Which ICT do children interact with? (2) Which skills do children have to use ICT? (3) On average, how much time do children use ICT in a day? (4) Where and with whom do children use ICT?

ICT in Early Childhood Education

Since the 1980s, ICT has changed the world rapidly. The 21st century has been labeled "the digital era" and new challenges for contemporary societies have arisen (Li &Ranieri, 2010). ICT has become a necessary part of our life. While accessing information, making connections or affecting the environment using electronic or digital tools, we all use ICT (Siraj-Blatchford &Siraj- Blatchford, 2003). In the context of early childhood education, Plowman and Stephen (2005) used a broad definition of ICT and included smart toys, remote control devices, photocopiers, telephones, fax machines, televisions, computers, mobile phones, laptops, cash registers, microwave ovens and barcode readers. Today, we can add to the list smartphones, game consoles, tablet pcs, touch screen devices, digital cameras, the internet, interactive stories, computer games, programmable toys, videoconferencing technologies, data projectors and electronic whiteboards.

Children's interaction with ICT has a long history. Televisions, telephones and toys were popularized in the 19th century. As time goes on, new forms of ICT have been invented. Hence, another large and diverse range of digital technologies like touch screen tablet devices such as iPads and certain smart phones are now available in homes (McPake, Plowman & Stephen, 2013).

Mishra and Joseph (2012) classify the research about early childhood education and ICT in five categories. First, some educators have conducted effect research which includes the positive and negative effects of ICT. They tried to identify the benefits of ICT to children and their education. Second, some investigations concern children's behavior surrounding ICT. These researchers examine, from a social perspective, children's interaction with ICT. Third, some researchers focus on early childhood teachers and other practitioners. These researchers determine key characteristics of effective ICT professional development. Fourth, there is research concerning model use of ICT in early childhood education settings and case studies. The last, and this research falls in this category, is research related to children's interaction with ICT. These studies identify children's access to, and use of, ICT at home or in early childhood education settings.

Vaala and Hornik (2013) examined the relationship between children's rates of TV/video viewing and their mothers' structural life circumstances and cognitions. Lepicnic and Samec (2013) determined that girls access ICT more than boys. Carson and Janssen (2012) identified several features in home settings that influence children's screen time and reported that age, parent attitude and parents' screen time positively affect children's screen time. Nikolopoulo, Gialamas and Batsouta (2010) investigated children's access to ICT at home. They stated that children have access to a wide range of ICT and boys play console games more than girls.

McKenny and Voogt (2010) conducted research about children's access to ICT at home and in other settings. They pointed out that children mostly play games with computers, boys are more ambitious to use computers than girls, but showed no difference in skills. Zevenbergen and Logan (2008) surveyed children using computers and reported that 85% of children have a computer in the home and that boys use the computer more than girls. One of the largest scale researches about children's interaction with ICT was conducted by Marsh et al. (2005) including 1,852 children, educators and 120 education settings. They touched on many points about children's use of technology and media. They reported that children consistently have interaction with ICT from birth and use technology balanced with other activities. Christakis, Ebel, Rivara and Zimmerman (2004) investigated children's TV viewing and usage of other media. They stated that parents' educational level has a negative effect on children's TV viewing duration. Rideout, Vandewater and Wartella (2003) conducted a large scale survey to determine children's interaction with technology and media. They indicated that children start watching TV from their early months and watch TV two hours a day.

The major studies concerning children's interaction with ICT have been summarized above. They all show important findings about children's access and usage of ICT. As it can be seen, young children have intense interaction with ICT. This interaction can significantly affect the development of young children as Bronfenbrenner (1979) emphasizes, stating that "…development is defined as the person's evolving conception of the ecological environment, and his [her] relation to it, as well as the person's growing capacity to discover, sustain, or alter its properties." In addition to Bronfenbrenner's ecological theory, the dramatic increase in young children's use of ICT leads us to propose the ecological techno-subsystem (Johnson & Puplampu, 2008). Thus, the understanding and interpretation of findings of research that aims to investigate children's interaction with ICT can provide new insight to best support their development.

Method

This study was designed as a baseline descriptive survey followed with causal comparative to determine the characteristics of the population and to determine the possible causes for any differences (Frankel & Wallen, 2009). First, it was attempted to describe kindergarten children's usage characteristics of ICT. Then, children's usage was compared according to variables including children's and parents' demographic characteristics.

Sampling

703 preschool children participated in the study from seven public kindergartens. Sampling was done using cluster random sampling which is obtained by using groups as the sampling unit rather than individuals (Frankel &Wallen, 2009). Seven kindergartens were randomly selected from the population. Then, approximately 100 children were randomly selected from each kindergarten. Thus, the proportions of children from each age group varied. The sample group of children consisted of 11.2% 36-48 month-olds, 31.6% 49-60 month-olds, 52.8% 61-72 month-olds and 4.4% 73+ month-olds. Also, 52.6% of the children were male and 47.4% were female.

Table 1. Demographic information of the sample (n=703)

Child age		***Child gender***		***Parent education level***	
36-48 months	*11.2%*	*Female*	*47.4%*	*Primary school*	*17.6%*
49-60 months	*31.6%*	*Male*	*52.6%*	*Middle school*	*82.4%*
61-72 months	*52.8%*			*High school*	*39.3%*
73+ months	*4.4%*			*College*	*15.2%*
				Bachelor's	*21.6%*
				Masters/PhD	*1.7%*
Parent age		***Parent gender***		***Income***	
20-30 years	*38.4%*	*Female*	*73.4%*	*Low*	*38.3%*
31-40 years	*51.8%*	*Male*	*26.6%*	*Middle*	*28.6%*
41-50 years	*9.5%*			*High*	*33.0%*
50+ years	*0.3%*				

The sample group of parents consisted of 73.4% female and 26.6% male. As to parents' ages, 38.4% were 20-30 years of age, 51.8% 31-40 years, 9.5% 41-50 years and 0.3% 51+ years. When it came to parents' education level, 9.5% were primary school graduates, 12.7% were middle school graduates, 39.3% were high school graduates, 15.2% were college graduates, 21.6% had bachelor's degrees and 1.7% had a master's or a PhD. Furthermore, 38.3% were low income, 28.6% were middle income and 33% were high income.

Data Collection and Analysis

A questionnaire was developed to collect data concerning preschool children's interaction with ICT. First, literature review was conducted to determine the content of the questionnaire. 108 items were produced at the end of this review. Television, computer, mobile phone and digital cameras were classified as ICT due to the research site's socio-economic characteristics. Second, the trial form was examined by eight experts specializing in early childhood education, ICT and test development. As a result of their views, 28 items were removed from the form due to their administrator scoring agreement lower than 80% and other essential revisions were also made. Third, the initial form was applied to 308 kindergarten children's parents to resolve the construct validity of the questionnaire. In the end, the items were categorized as access, levels of usage, skills and social structure. Frequency, percentage, mean and standard deviation were used to describe children's access, usage, skills and social structure concerning ICT.

Results and Discussion

Access

In this study, it is seen that the most accessible technological tools in children's houses were TV and mobile phones. Furthermore, robotic toys and game consoles were placed at bottom. Other tools in Figure 1 were at similar levels (about 50%), apart from the computer.

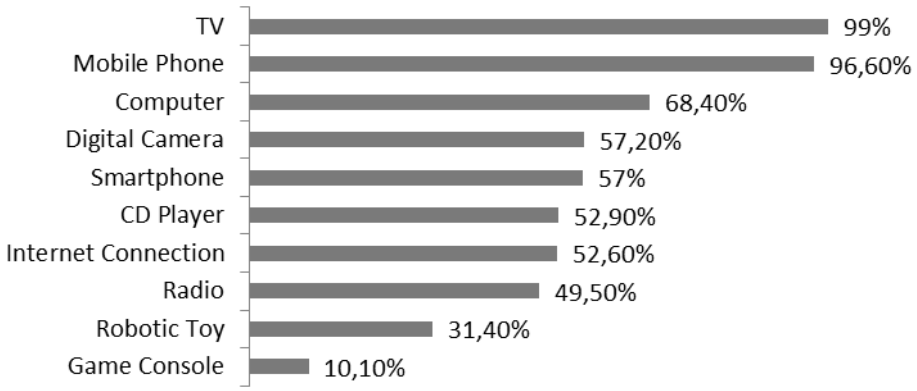


Figure 1. Percentages of ICT which children have access to at home (n=703)

Research about children's access to ICT (Rideout et. al., 2003; Marsh et. al., 2005) underscore that children have a technologically rich environment. They found that the most accessible ICT was TV, like this study. Also, we found the computer to be 68.4% and an internet connection 52.6%. Rideout et al. (2003) found these percentages respectively 77%- 67.8% and Marsh et al. (2005) found them to be 81%-73%. Increasing internet connection prevalence and decreasing computer prevalence may be due to the pervading use of the internet and various computer forms like smart phones, tablet PCs etc. Furthermore, Marsh et al. (2005) found radio prevalence to be 90% and CD players to be 98%. When comparing their findings to ours, there is a sharp decline. This reduction may due to the integration of camera, radio and CD player into computers and smart phones. In any case, it can be concluded that young children have access to some forms of ICT. The extensive access to ICT can contain potential benefits for enhancing and supporting the education of young children.

Levels of Use

On a typical day (see Figure 2), the mean number of minutes children watched TV was 115, almost 2 hours. Also, the mean number of minutes children used computer was 27, nearly half an hour. Furthermore, listening to music and playing console games were less than other activities children engaged with on a typical day. The highest rate of ICT children's time consumed in this study was with TV for 115 minutes. There are several research studies about children's TV viewing duration. Cheng et al. (2004) found a TV viewing duration of 2.56 hours in a day. Dennison, Russo, Burdick & Jenkins (2002) pointed out that female preschool children's TV viewing duration was 12.5 hours and males' was 13.5 hours in a week. Nicole, Shanti, Richard & Robert (2007) stated the duration was more than 2 hours in a day. Turkkent (2012) pointed to a duration of 15.5 hours per week. Also, Cox et al. (2012) found a duration of 1.5 hours in a day. Carson and Janssen (2012) determined the duration to be 1.11 hours a day. In the preschool period, TV watching is more attractive than other activities, more accessible because of the universality of TV and because TV can be watched easily, this may be the reason for children preferring TV viewing instead of other activities (Larson, Kubey&Colletti, 1989). When it comes to quantity of children's TV viewing minutes, there must be a maximum of 14 hours per a week according to the American Pediatric Academy (Healey, 2004). However, to Cox et al. (2012) it must be maximum of 1 hour per day. Because the recommendations of Cox and his colleagues are more recent, 115 minutes of TV viewing is regarded as above the limit.

In the study, nearly half of the children use the computer for an hour a day. Rideout et al. (2003) found this duration to be 16 minutes and Marsh et al. (2005) found it to be 6 minutes. Fish et al. (2008) pointed out that 11% of children use the computer more than an hour a day. Akcay and Ozcebe (2010) stated that children use the computer for 32 minutes on weekdays and 96 minutes at the weekend. If sampling of this study's access to computer taken into account, which was 68.4%, 28 minutes is a satisfying mean.

In addition to all the findings concerning children's ICT usage duration, unlike some research arguments (Haugland, 2000; Fomichova & Fomichov, 2000; Yelland, 1999; Healey, 1998), children not only interact with ICT, but also do other essential activities for their development.

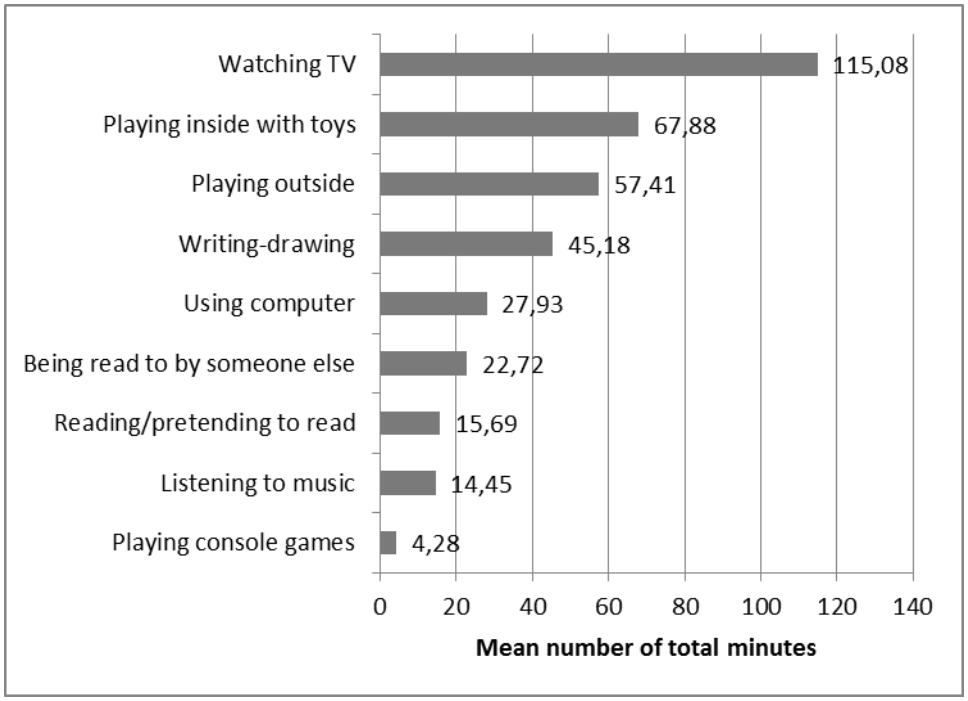


Figure 2. Children's activities mean total minutes

Skills

It is important to determine which skills children have to use ICT. By determining the skills children have, appropriate activities and applications may be developed for children. Nearly all children can watch TV and freely change channels with a remote control (see figure 3). However, only 4% of these children can turn the TV on or off by themselves. Marsh et al. (2005) stated that 98% of children start watching TV at age 2, 88 % turn on/off the TV by themselves at an average age of 4, and 70% can change the channel with a remote control at an average age of 3. Rideout et al. (2003) reported that 78% of children watch TV and 91% of these children turn on/off TV by themselves and 75% can change channels with a remote control. One of the reasons for children's high level of skills related to the TV can be the widespread presence of TV.

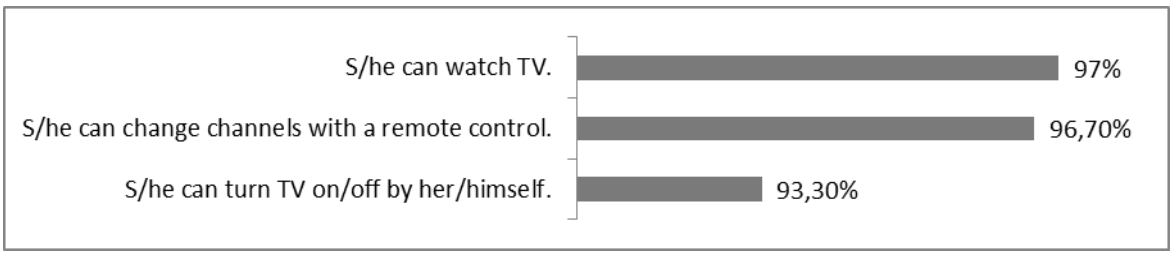


Figure 3. Children's TV capabilities

When it comes to children's computer skills, more than half of the children can use a computer freely (see Figure 4). 82% can use a mouse to point and click which is an essential skill to use a computer. Rideout et al. (2003) pointed out that 64% and Zevenbergen& Logan (2008) 80.45% can use a mouse to point and click. It can be seen that percentage of mouse usage capability rises over time. Another essential skill to use a computer independently is that of turning on/off the computer and 70% of children can turn the computer on/off by themselves. Rideout et al. (2003), and Zevenbergen and Logan (2008) found this skill's percentiles as 37% and 25.56%, respectively. This may be due to children's rising access to computers. Furthermore, 62% of kindergarteners can put a CD into a computer and nearly half of them can look at websites. However, only 30% can go to a particular website by themselves.

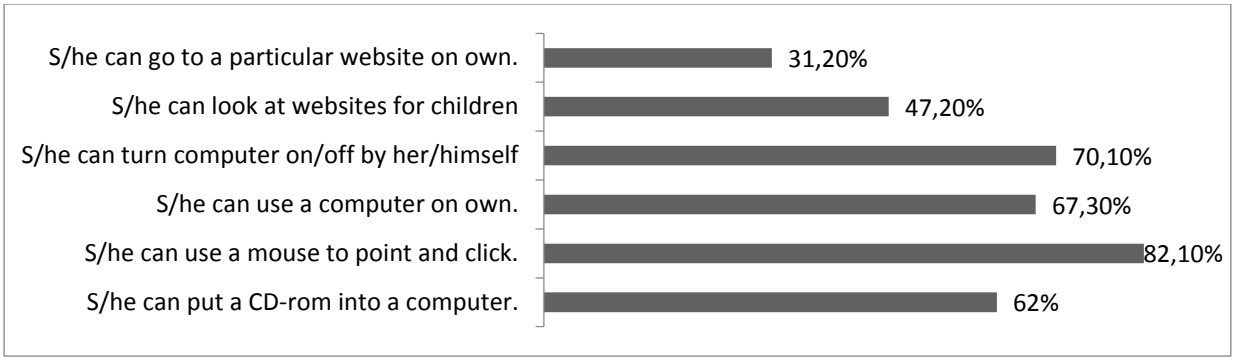


Figure 4. Children's computer usage capabilities

Mobile phones attract children's interest, so they have many skills related to mobile phones. They use a mobile phone as a camera, 89.8% of them can use a mobile to take a photo and 75.7% can record a video using a mobile. Also, they can play games on a mobile and play with ringtones. 80% can understand and state when a text message arrives. However, their skill to call someone with a mobile is a bit lower when compared to other skills. When it comes to Marsh et al.'s (2005) findings about mobile phones, 14% could use a mobile to call someone and 24% could play with ringtones. The rising percentiles of mobile usage can be attributed to the ever-increasing popularity of mobiles.

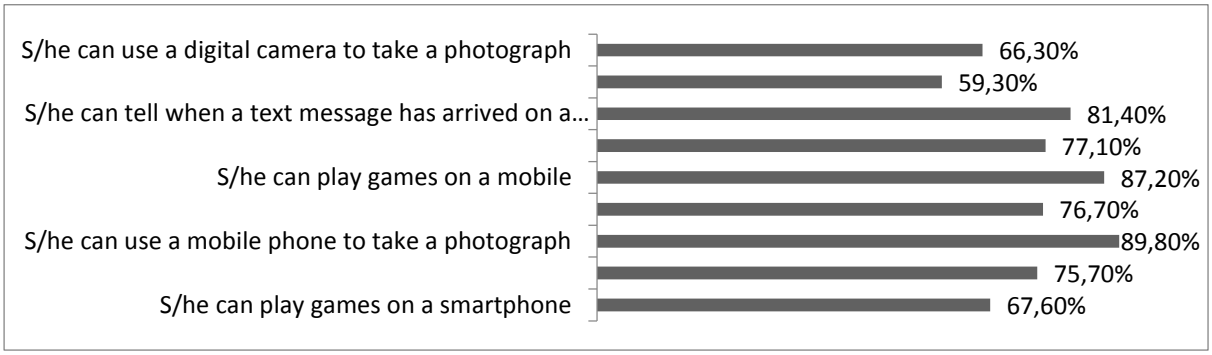


Figure 5. Children's capabilities of using digital cameras and mobile phones

Social Nature of Using ICT

When we investigate where and with whom children use ICT, we see that children are not alone. They almost always use ICT in a shared room with other family members (see Table 2). However, they usually prefer to use ICT on their own (see Table 3).

Fomichova and Fomichov (2000) stated that playing on computers could lead to children's isolation from social interaction and violence in computer games could lead to aggressive behavior. It is not a reality that children's interaction with ICT pushes them into loneliness (Marsh et al., 2005). The results of this study tell us that interaction with ICT does not affect children negatively. They not only use ICT but also do other essential activities for their development in a typical day (see Figure 2). Also, they interact with ICT in the living room where an adult may be close to them. However, children's tendency to use ICT on their own may be a result of having enough skills to use ICT independently.

Table 2. Most frequent activity locations (n=703)

	In his/her bedroom	In the living room	In the kitchen	In another room in the house	Never does this
	%	%	%	%	%
S/he watches TV	4.1	91.2	1.1	2.1	1.4
S/he listens to music	12.8	46.9	4.1	5.7	30.4
S/he uses a computer	21.6	31.4	1.4	11.0	34.6
S/he plays console games	8.3	11.4	1.0	3.3	76.1

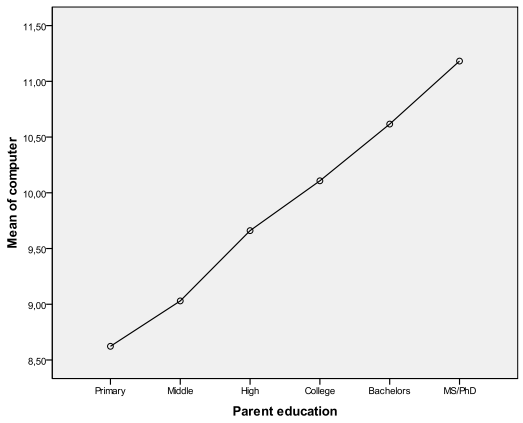
Table 3. The people children do the activities with most of the time (n=703)

	On own	With another child	With an adult	Never does this
	%	%	%	%
S/he watches TV	79.2	7.3	11.8	1.7
S/he listens to music	40.3	10.0	21.3	28.4
S/he uses a digital camera	41.8	2.6	18.2	37.4
S/he uses a computer to play "fun" games.	44.7	9.1	18.2	28.0
S/he uses a computer to play "educational" games.	22.0	4.0	21.9	52.1
S/he uses a computer to write/draw	38.8	3.4	15.2	42.5
S/he visits websites	17.1	2.3	19.2	61.5
S/he uses a mobile phone to make calls	45.8	2.3	13.2	38.7
S/he plays games on a smartphone	34.1	1.1	22.2	42.5
S/he plays console games like Playstation/Xbox	11.1	3.1	8.8	77.0

Factors Affecting Children's Interaction with ICT

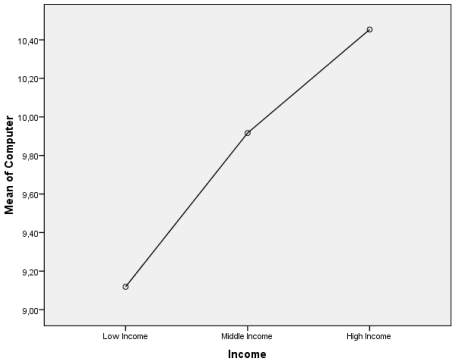
It is investigated that reasons for differences in children's usage characteristics of ICT. Before the analysis, normality and homogeneity of variance assumptions were checked. Skewness and kurtosis values of groups were not between -2 and 2. Thus, as normality assumption for parametric tests was not satisfied, nonparametric statistics were used. When it comes to the results, first, children's gender influences their duration of computer usage. A Mann-Whitney U test indicated that boys (Mdn=20) use a computer more than girls (Mdn=0) significantly, U=51680.5, p<.05, r=.01. This result is parallel to some research found in the literature. Zevenbergen and Logan (2008) stated that gender had an impact on children's computer usage and boys were ahead of girls. Also, Akcay and Ozcebe (2010) pointed to gender's influence on children's computer usage.

To our surprise, in this study, parents' educational level does affect children's computer usage skills (see Graph 1).



Graph 1. Means plot of computer usage scores of children and parents' educational levels

A one-way, between-groups analysis of variance was conducted to explore the differences in computer usage scores for children with different levels of parent educational status. There was a statistically significant difference at p<.0005 level in computer usage scores for six parent educational levels: F(5,566)=12.77, p<.0005. The effect size, calculated using eta squared, was .22. Post-hoc comparisons using the Scheffe test indicated that the mean score for Primary (M=8.62, SD=2.33) was significantly different from High (M=9.66, SD=2), College (M=10.1, SD=1.8), Bachelors (M=10.62, SD=1.56) and MS/PhD (M=11.18, SD=.98). Also, Middle (M=9.02, SD=2.18) was significantly different from College (M=10.1, SD=1.8), Bachelors (M=10.62, SD=1.56) and MS/PhD (M=11.18, SD=.98). Furthermore, High (M=9.66, SD=2) was statistically different from Bachelors (M=10.62, SD=1.56).



Graph 2. Means plot of computer usage scores of children and parents' income

In addition, the monthly incomes of parents have an effect on children's computer usage skills. The one-way, between groups analysis of variance yielded a significant difference when an investigation was conducted into the difference of computer usage scores for children with different levels of parents' monthly income $F(2,569)=24.95$, $p<.0005$. The effect size, calculated using eta squared, was .18. Post-hoc comparisons using the Scheffe test indicated that the mean score for low income (M=9.12, SD=2.18) was significantly different from middle income (M=9.92, SD=1.86) and high income (M=10.45, SD=1.72). Also, middle income was significantly different from high income. When it comes to the effect of income, the gap of access to mobile devices and applications between higher income and lower income is reported (Rideout, 2013). The issue of equality is also pointed out by the NAEYC (National Association for the Education of Young Children) & Fred Rogers Center, (2012).

Conclusion

In order to prepare children for their future technologically-equipped world, the introduction of children to ICT is inevitable (Plowman, Stevenson, McPake, Stephen & Adey, 2011). To make children ready for this future world, an understanding of the nature of interaction between children and ICT may provide a basis.

In this study, one of the most widespread ICT is television and children watch it nearly two hours a day. Also, they spent their time with computers and music players. Children must, however, be allowed time for traditional activities. This refers to a balance between technological time and traditional time. Cordes and Miller (2000) and Van Evra (2004) argued that technology may take the place of natural activities. However, as Marsh et al. (2005) reported, children spend their time by both using technology and doing traditional activities. Thus, the question of how to use technology in early childhood education may be the issue of further research rather than whether to use it or not. Furthermore, ICT use and natural activities can be combined to investigate children's behaviors and developments.

As a result of the interaction that is presented above, children have many skills to command technology. They have a variety of skills to watch television, use the computer and interact with other technologies for different aims. They become more independent when they have skills to use particular forms of ICT. However, this independency does not yield any socially isolation of children which was advocated by the American Academy of Pediatrics (2011). The foundation claims that "…computers can isolate children, emotionally and physically, from direct experience of the natural world," (American Academy of Pediatrics, 2011). But, children interact with ICT almost always in a shared room in which a member of their family can reside and monitor them. Also, to Lim (2015), children socially interact with peers while engaging in computer activities. Thus, it can be supported that technology is not a social barrier between a child and other people. However, to guarantee the well-being of children, the social nature and interactions between children and family members around technology must be investigated to support a family atmosphere.

Parents' demographics play a role in children's interaction with ICT, especially with computers. The effect of parents' educational levels and monthly incomes on children's computer skills may produce problems of equality. Children growing up in a technologically equipped environment start to use technology at an early age when compared to children in families with less access to the latest forms of ICT (Cross, Woods & Schweingruber, 2009; National Association for the Education of Young Children & Fred Rogers Center, 2012). When ICT is appropriately integrated into early childhood education settings, equity is addressed by supporting children who have less access to ICT (Judge, Puckett & Cabuk, 2004). To close the gap between disadvantaged

children and children who have access to ICT, integration of technology into early childhood education should be hastened. Awareness of teachers to support these children, equipping classrooms, and integration of technology into curriculums may solve the problem of equality.

The knowledge of young children's usage of technology and their intentions when using technology can be useful for parents, early childhood educators, and policy makers. In addition, ICT developers can use this knowledge for producing developmentally appropriate software and hardware.

Notes

This study was conducted as a master thesis by the first author under the supervision of the second author.

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