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Parental Perceptions of Electronic Media Use by Children with Attention Deficit Hyperactivity Disorder and Non-Referred Children in Greece

Aglaia Stampoltzis* 
Harokopio University of Athens, GREECE

Efstathia Voulkidou 
Ministry of Education, GREECE

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Abstract: Television watching and video/computer playing are favorite leisure activities among children and adolescents. Individuals with attention deficit hyperactivity disorder (ADHD) have several special characteristics in relation to attention and impulsivity compared with non-ADHD individuals. This study investigates parental perceptions of electronic media use among children and adolescents with ADHD and a control group. A total of 54 participants with ADHD and 51 controls aged 7-15 years old took part in the study. A questionnaire was constructed to collect quantitative data from parents. ADHD children tend to spend more time per day on electronic devices compared to non-referred children. Age but not gender seemed to affect the frequency of children's media play. Inattention, anxiousness and disorganization are more common in the ADHD group in activities such as reading, doing homework, doing sports or playing with toys in comparison to media activities. Parents of both groups worry a lot about their child's habits of videogame playing. Finally, parents of ADHD children recognize some of the benefits of videogames in the areas of memory, attention and motivation but not in the academic area. In conclusion, the present study highlights important aspects of the topic of media use by children with ADHD as well as risk factors to take into account.

Keywords: Attention deficit hyperactivity disorder (ADHD), electronic media use, parental perceptions, video games.

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Introduction

Over the last decades, children and adolescents (especially in the age group of 8-18) spend many hours a day in front of television and video games, whereas at the same time their engagement with reading and sports has decreased (Armendarez, 2015; Rideout et al., 2003). In addition, symptoms, such as inattention, hyperactivity and impulsivity are rising up, while the Center for Disease Control and Prevention (2010) reports that about 9.5% of children and adolescents (aged 4-17) have attention deficit hyperactivity disorder (ADHD) based on parent report. According to the American Psychiatric Association (APA, 2013) the prevalence of ADHD in school-aged children has been estimated at around 5%. Medical and educational professionals express their concern about the increasing ADHD symptoms in the population.

Sigman (2010) emphasizes the negative impact of the frequent use of electronic media in children younger than 5 years old, because it puts their typical development, their language acquisition and even their sleep habits in danger. Armendarez (2015) underlines that today children and adolescents are very much engaged in technology-based play, but there is some doubt about the potential benefits for their behavior and cognitive development.

According to Swing et al. (2010) the use of electronic devices tends to intensify behaviours which are related to ADHD symptomatology such as nervousness, impulsivity and attention problems, especially if children and adolescents do not respect the American Academy of Pediatrics' limit of the two-hour maximum of daily video game and television exposure. In addition, video games put children and adolescents at risk for developing low self-control and addictive tendencies because of their fast pace of movement, speed rotation and actions that promote violence (Armendarez, 2015). However, several studies (Boot et al., 2008; Dye et al., 2009) report some benefits for video game players in executive functioning

* Corresponding author:

Aglaia Stampoltzis, Harokopio University of Athens, Athens, Greece. ✉ lstamp@hua.gr



skills such as attention and planning, mental rotation, decision-making, object tracking and resistance to masking. The bidirectionality of the relationship between electronic games and ADHD symptoms deserves special attention and further investigation, since it is not yet clear to what extent and under which circumstances the use of electronic devices offers benefits in special domains, e.g., cognitive, motivational or social (Armendarez, 2015).

Literature Review

Recent Trends and Perspectives on ADHD

ADHD is a neurodevelopmental disorder characterized by persistent symptoms of inattention, hyperactivity and impulsivity (Badía & Raga, 2015). ADHD is not a modern disorder, since the first description of symptoms highly resembling to what currently could be characterized as ADHD is attributed to Still (1902). ADHD is distinguished in three types, the attention deficit type, the hyperactivity/impulsive type and the combined type (Wilmshurst, 2011). The latter combines the symptoms of the two other types.

According to National Institute for Care and Health Excellence (NICE, 2018) report, for an ADHD diagnosis, symptoms of hyperactivity/impulsivity and/or inattention should meet the diagnostic criteria in the DSM-5 or in the International Classification Diseases (ICD-10). The symptoms of the disorder should have lasted at least six months and should be disproportionate to the child's age, creating impairment in two or more important settings, including social/family and educational settings. Moreover, the disorder must be set before the age of 12 (APA, 2013). Boys are more prone than girls to being diagnosed with ADHD. ADHD should be considered in all age groups, with symptom criteria adjusted for age-appropriate changes in behavior (NICE, 2018). Social difficulties as well as interpersonal difficulties are often observed in ADHD children (Nixon, 2001).

In addition to children who have an official diagnosis of ADHD by professionals, there are also some children whose parents and teachers report 'attention problems' for them. This second group represents a separate sub-category among children (Loiselle, 2015, p.6).

Previous Research on Attention Problems and Electronic Media Use

Electronic media use has completely penetrated everyday life, with televisions, video games, computers and internet (Rideout et al., 2003). In fact, only the study conducted by Milich and Lorch (1994) carefully compared the frequency of television viewing by children with ADHD and a control group and found no statistical differences between the two groups. However, other studies which related television viewing with the presence of attention problems among non-referred children, they tried to apply their findings to children with ADHD (i.e., Christakis et al., 2004; Levine & Waite, 2000).

In a well-designed study attempting to overcome the drawbacks of previous studies, Acevedo-Polakovich et al. (2007) using an experimental and a control group, found ADHD children to watch TV more hours and more intensively than their non-referred peers. The former enjoyed reading less and spend less time on reading in comparison to the latter. The important aspect of this study is that it tries to explain the pattern of increased television viewing with impairments associated with ADHD and other factors, such as having a TV in the child's bedroom, having parents who watch TV themselves etc. In fact, this study underlines the role of parents who regardless of their child's status (ADHD or not), they should recognize both the advantages and disadvantages of television viewing under specific circumstances (Acevedo-Polakovich et al., 2007).

In reviewing the literature about the use of video games by children with and without ADHD, one can trace at least four possible factors pertaining to the association between video game use and ADHD behaviours. According to Gentile et al. (2012) the first possibility is that gender is the cause for the association since boys spend much more time than girls playing video games and they have more possibilities to display ADHD symptoms (Kietglaiwansiri & Chonchaiya, 2018). Secondly, students who are frequent video game players may lose interest in other activities (homework, reading etc) and conversely their reading and/or social difficulties may account for their increased video game playing and involvement (Acevedo-Polakovich et al., 2007). Thirdly, teenagers who are engaged in video games for increased periods of time may have difficulties in obtaining attention and self-control, as several researchers report (Armendarez, 2015; Christakis et al., 2004; Johnson et al., 2007). The final possibility is the conclusion supported by Chan and Rabinowitz (2006) about the bidirectional causality between video games and attentional problems. According to them, it is not sure "if playing video games for an hour or more daily leads to an adolescent exhibiting ADHD behaviours or if adolescents who exhibit ADHD behaviours play video games for longer periods of time than their counterparts without ADHD" (Loiselle, 2015 p.21). An interesting finding related to the last possibility is Gentile et al.'s (2012) conclusion from their large-scale study of 3034 children suggesting that the largest predictor for attention problems and impulsiveness is the total time spent playing video games.

There is also a trend in the literature examining the possibility that the success of children with ADHD in certain video games in comparison to their peers without ADHD depends on the type of game (Bioulac et al., 2012; Shaw et al., 2005). From these two studies, it can be concluded that some video games are more fascinating for children with ADHD

than others, because of their more visually appealing layouts. Because of the nature and core characteristics of ADHD, the attractive visuals of some games, their fast pace and movement make children with ADHD more interested in them (Swing et al., 2010).

Several researchers (Gentile et al., 2012; Koepp et al., 1998) underline the increasing possibility of the pathological use of electronic media by children or teenagers with ADHD, because they are not satisfied with 'natural rewards' (such as love, enjoyment of eating) and they are looking for 'unnatural rewards' (such as video games, risk-taking behaviours etc) to feel happy and satisfied.

Granic et al. (2014) propose a way to assess the positive characteristics of video game playing within the cognitive, behaviour and social domain, although the emphasis is mainly on the first one. Two studies (Chuang et al., 2010; Garagouni-Areou & Solomonidou, 2004) present findings to support that the special purpose of certain video games as well as their visual cues and graphics resulted in better attention focus in ADHD children. It seems that children with ADHD exhibit an increased level and attention span during a short, visually appealing task.

Parental Perceptions and Electronic Media Use

The role of parents becomes important when they put the rules and the time limit for electronic media use by their children. The perceptions of video games exhibited by parents influence youths' video game use. According to Nikken and Jansz (2006) who observed 536 parent-child dyads, parents were found to monitor the types of video games their child played, forbade several games, evaluated the games selected by their children and finally spent time playing video games with them. Families from low socio-economic status were found to evaluate more often the positive and negative aspects of the video games more often, although their children spent as much time to video gaming as children from high socio-economic status.

Armendarez (2015) explored in depth parents' perceptions of their children's digital media use as well as their level of concern regarding video gaming and ADHD symptoms. He discovered that only on weekends and during vacations did parents of children with ADHD report that their children played video games more frequently than other children from a nationally representative sample of children. Male youths play more video games than female youth and 11-14 years-old adolescents play more video games than 5-7 years old children. According to the majority of parents in the sample, their offsprings displayed fewer ADHD behaviors when playing video games, supporting the theory that when kids with ADHD are strongly motivated in an activity, they may exhibit fewer impulsive, hyperactive, inattentive, and impulsive behaviors (DuPaul & Stoner, 2014). A majority of parents, however, do not feel that the types of video games their children are playing contribute to their academic and behavioral improvements.

Pasquier et al. (1998) study how family style characteristics are reinforced by media use in a comparative survey of Flemish, French, Italian and Swedish children and adolescents. They came to a series of important conclusions showing that media are a shared experience with other family members and parents' attitude towards their children's media use is correlated with their more general education patterns to bring them up. It is evident that electronic media use affects family life in many ways. As far as TV viewing is concerned, Acevedo-Polakovich et al. (2007, p. 467) concluded that "children with ADHD are more likely to watch television in the company of their parents than are non-referred children. It may be that viewing television is one of the few times when parents can spend relatively conflict-free time with their child who has ADHD".

Another body of research focuses on specific symptoms and game features related to problematic video game use across groups (Mazurek & Engelhardt, 2013; Tolchinsky, 2013). Parents give detailed accounts about their children's habits and routines with media use. According to Mazurek and Engelhardt (2013), boys with ADHD have greater in room access to video games than did boys with typical development. There is also a bidirectional relationship between greater access and problematic use or preoccupation. Parents may find it hard to put time limits on their child's preoccupation with video games because of his/her difficult or disruptive behavior.

To sum up, much research has been conducted in the field of electronic media use and their effect on children with or without ADHD. The bidirectionality of the relationship between electronic games and ADHD symptoms needs further investigation, while many different variables should be taken into account.

Methodology

The aim of the study is to investigate patterns of electronic media use as described by parents in a Greek sample of ADHD children compared to a control group. In addition, an attempt is made to shed light on whether TV and media exposure are associated with greater attention and behavior problems related to ADHD, according to parental evaluations of their children's difficulties. This study is novel because it is the first study in Greece attempting to examine the relationship between media use and ADHD characteristics taking into account the child's condition (ADHD or typical development), gender and age. It addresses 5 questions:

(1) How similar or different are the ADHD children's patterns of time spending in media use or in other activities (e.g doing homework, watching TV) in comparison to the control group?

(2) Are there any gender or age differences in the time spent on media use by ADHD children, as reported by their parents?

(3) Are there differences in the level of attention problem, anxiousness/nervousness in and disorganization in various activities, as reported by parents, between ADHD children and their counterparts?

(4) Are there differences in the level of concerns about media use between parents of the ADHD group and parents of the control group?

(5) To what extent are parents' perceptions of the benefits of video games similar or different for the two sample groups (ADHD and control group)?

Participants

The sample consisted of 105 parents, 54 parents of children with a formal diagnosis of ADHD and 51 parents of children with typical development ranging in age from 7-15 years old. The main characteristics of the sample are given in Table 1. Parents of ADHD children were recruited through ADHD HELLAS and Noesi, two non-profit organizations for children with disabilities in Greece, and parents with TD children were contacted through social media and word-of-mouth recruitment.

Table 1. Sample Characteristics

Sex	Parents of ADHD children (n=54)		Parents of TD children (n=51)	
	(f)	%	(f)	%
Man	9	8.6%	9	8.6%
Woman	45	42.9%	42	40%
Age (y)				
20-30	1	1%	0	0%
31-40	18	17.1%	27	25.7%
41-50	32	30.5%	22	21%
51+	3	2.9%	2	1.9%
Area of residence				
Athens	35	33.3%	2	1.9%
Salonica	7	6.7%	49	46.7%
Other city	12	11.9%	0	0%

The demographic characteristics of the 105 children recruited in this study are summarized below: The ADHD group consisted of 35 boys (n=35) and 19 girls (n=19) and constituted 51.4% of the total sample. Similarly, the control group consisted of 28 boys (n=28) and 23 girls (n=23) and constituted the 48.6% of the total sample. The mean age the mean of the ADHD group (n=54) is 135.31 months (11 years old), while for the control group (n=51) is 126.92 months (10.5 years old). To be sure that the children were assigned to the correct group, inattention and hyperactivity/impulsivity symptoms were assessed in all children by Vanderbilt ADHD Parent Rating Scale (VADPRS). The VADPRS has good internal consistency, validity and reliability and has been used in similar studies (Mazurek & Engelhardt, 2013). In our study Cronbach's alpha was 0.95. The results showed that the children of the ADHD group (n=54) achieved higher scores in all three types of ADHD than the control group (n=51). Thus, the mean scores were: Attention subtype (15.80 vs. 2.78), hyperactivity/impulsivity subtype (18.22 vs. 5.63), combined subtype (34.02 vs. 8.41). The non-parametric Mann-Whitney test (U) was used to compare the means ranks of the two groups. The differences were statistically significant in all types of ADHD at the $p < 0.001$ level.

Measures

For the purpose of the study a questionnaire was constructed on the basis of the literature and similar instruments (Armendarez, 2015; Tolchinsky, 2013). Apart from demographic variables, questions about the child's characteristics across different activities, time spent on various activities during weekday and weekend, parental perceptions and concerns about their children's video game and media use were answered by the parents. Parents reported ADHD subtype features in various activities on a four-item scale (Never, Sometimes, Often, Always). Parents were then asked, for instance, how frequently their kids get distracted and inattentive while doing things like playing A) video games, B) doing their homework, C) watching TV, or D) building with Legos etc. Parents then were asked to report the minutes their child spent on various activities (eg., watching TV, reading, playground time etc.) daily, during weekends and vacations, selecting between five different options (None, <30 min., 30-60 min., 60-120 min., >120 min.). Next, parents expressed their concerns about their offspring's playing video games on a five-point scale (Not at all, A little bit, Somewhat, Quite a bit, A great deal). A final question asked concerns if parents believe that electronic media can help their children in respect of academic and cognitive development (scale: Not at all, A little bit, Somewhat, Quite a bit, A great deal).

Cronbach α was calculated for the separate parts of the questionnaire and ranged from 0.67 to 0.92. Non-parametric analyses were performed because of the normality of the variables and the number of participants in each group.

Procedure

Participants were approached via the Hellenic Association of Attention Deficit Hyperactivity Disorder (www.adhdhellas.gr) and the Noesi Organization (www.noesi.gr). Both organizations informed their members about the study and gave contact details to parents with children with ADHD if they wanted to participate. Questionnaires were completed either manually or electronically by one parent (usually the mother). The researcher was available for help and support. Parents in the control group were contacted through social media or they were the researchers' acquaintance. The eligibility criterion was to have children without ADHD or learning difficulties aged 7-15 years old.

Analyzing of Data

Data were analysed using IBM SPSS version 25. Descriptive statistics were first obtained for all measures. Non-parametric inferential analyses were then performed to examine the relationships among the variables considered in the current study.

Findings / Results

Frequency of Use of the Electronic Devices

In this section we examine the amount of time spent in various activities during school days and weekends by children with ADHD and the control group with reference to the first research question of the study. Table 2 presents the mean scores (and S.D) of both groups in a 5-point Likert scale (0=not at all, 1=up to 30 minutes, 2=30-60 minutes, 3=60-90 minutes, 4=90-120 minutes). The *Mann-Whitney test revealed significant differences in the time spent per day by children on sports activities, Internet surfing, playing computer and playing videogames with the children in the ADHD group spending less time on sports* [$U(54,51)=906,5$, $p=0.002$, $R^2=0.11$] *and more time on internet surfing* [$U(54,51)=1,03$, $p=0.022$, $R^2=0.06$], *computer playing* [$U(54,51)=1,069.5$, $p=0.041$, $R^2=0.45$] *and videogames* [$U(54,51)=1,091.5$, $p=0.048$, $R^2=0.036$] *than the control group.*

Table 2. Means (M) and Standard Deviations (SD) of the Time Spent by Children in Various Activities per Day (N=105)

School days	ADHD group (n=54)	Control group (n=51)	p
	M (SD)	M (SD)	
Watching TV	1.76 (1.33)	1.61 (1.00)	.714
Doing homework	2.56 (1.13)	2.80 (0.82)	.382
Sports	1.57 (1.25)	2.35 (1.11)	.002*
Using the mobile phone	0.94 (1.45)	0.55 (0.94)	.406
Music	1.02 (1.25)	0.88 (0.93)	.907
Surfing on the internet	1.81 (1.49)	1.12 (1.05)	.022*
Playing with his/her toys	0.87 (1.27)	0.82 (0.91)	.503
Playing on his/her computer	1.65 (1.42)	1.06 (1.05)	.041*
Playing videogames	1.35 (1.49)	0.76 (1.07)	.048*
Playing with his/her friends	1.19 (1.39)	1.27 (1.25)	.605

* $p<0.05$

As far as the weekend is concerned, children play more time with electronic devices during the weekend according to their parents' views (mean scores 1-2.72) but no significant differences were observed between the two groups during weekdays.

Gender and Age Differences in the Time Children Spent on Electronic Devices

In this section we report findings related to the second research question, concerning the time children spent on electronic devices with reference to gender and age. In both groups, (ADHD and controls), gender wasn't found to affect the time spent on electronic devices whereas age seemed to affect children's engagement.

More specifically, in the ADHD group, statistically significant differences were observed between 7-9, 9-11 and 11-13 years old in the variables of *talking on the mobile phone* [$H(52)=23,733$, $p=0.000$, $\eta^2=0.450$], *surfing on the internet* [$H(52)=12,138$, $p=0.002$, $\eta^2=0.281$], *playing computer games* [$H(52)=9,300$, $p=0.010$, $\eta^2=0.178$], *playing games* [$H(52)=9,488$, $p=0.009$, $\eta^2=0.06$] *and playing video games* [$H(52)=6,715$, $p=0.035$, $\eta^2=0.148$] (Table 3). In the control group, statistically significant differences were found in *talking on the mobile phone* [$H(49)=17,335$, $p=0.000$, $\eta^2=0.195$], *surfing on the internet* [$H(49)=9,366$, $p=0.009$, $\eta^2=0.162$] *and playing games* [$H(49)=10,972$, $p=0.004$, $\eta^2=0.187$] (Table 3). The mean score (and SD) to make the comparison is calculated in the 5-point Likert scale (0=not at all, 1=up to 30 minutes, 2=30-60 minutes, 3=60-90 minutes, 4=90-120 minutes).

Table 3. Means (M), Standard Deviations (SD) and Kruskal-Wallis Test about the Dedicated Time to Various Activities During a School Day According to the Age of the Child (N=105)

84-108	ADHD group (n=54)				Control Group (n=51)			
	Mean±SD	109-144 Mean±SD	145-180 Mean±SD	p	83-108 Mean±SD	109-144 Mean±SD	145-187 Mean±SD	p
Watching TV	2.08±1.24	1.83±1.37	1.47±1.35	.421	1.44±0.89	1.75±1.15	1.55±0.82	.571
Reading/ doing homework	2.25±1.22	2.70±0.93	2.58±1.31	.573	2.75±0.68	2.83±0.92	2.82±0.87	.961
Sports	1.83±0.94	1.65±1.36	1.32±1.34	.481	2.19±0.98	2.38±1.06	2.55±1.44	.517
Talking on their mobile phone	0.00±0.00	0.43±0.95	2.16±1.61	.000*	0.13±0.34	0.50±1.02	1.27±1.01	.000*
Listening to music	1.00±1.21	0.70±1.11	1.42±1.39	.140	0.63±0.72	0.79±0.59	1.45±1.51	.298
Surfing on the Internet	0.67±0.65	1.74±1.39	2.63±1.54	.002*	0.50±0.73	1.38±1.13	1.45±0.93	.009*
Playing games	1.42±0.99	0.70±1.18	0.74±1.49	.009*	0.94±0.85	1.08±0.97	0.09±0.30	.004*
Playing computer games	0.58±0.52	2.13±1.33	1.74±1.59	.010*	0.69±0.95	1.17±1.01	1.36±1.21	.162
Playing videogames	0.42±0.52	1.91±1.47	1.26±1.66	.035*	0.56±0.89	0.83±1.01	0.91±1.45	.634
Playing with their friends	1.75±1.22	0.74±1.05	1.37±1.71	.083	1.07±1.18	1.54±1.18	1.00±1.48	.260

p<0.05

ADHD Related Behaviors During Various Activities

In this section we examine the ADHD related behaviors of children with reference to research question 3. Table 4 presents means scores, standard deviations and statistically significant results for both groups with reference to attention symptoms during various activities. Mean scores close to 0 corresponds to 'never be distracted' while mean scores close to 3 corresponds to 'very often be distracted'.

Table 4. Means (M), Standard Deviations (SD) and Mann-Whitney Test (U) Results About Inattention Symptoms During Various Activities (N=105)

Attention difficulties	ADHD group (n=54)		Control group (n=51)		p
	M	SD	M	SD	
Playing video games	0.39	0.685	0.78	0.702	.001*
Reading or doing homework	2.19	0.754	0.94	0.614	.000*
Discussing with family or others	1.30	0.861	0.59	0.698	.000*
Doing chores	2.15	0.979	0.90	0.900	.000*
Watching TV	1.00	0.847	0.76	0.737	.156
Playing with his/her toys	0.98	1.000	0.41	0.638	.001*
Playing on the computer	0.52	0.841	0.65	0.658	.101
Surfing on the internet	0.48	0.720	0.63	0.662	.147
Playing with his/her friends	0.72	0.685	0.43	0.608	.021*
Playing board games	1.20	0.939	0.51	0.674	.000*

p < 0.05

As one can see from Table 4, statistically significant differences are observed between the ADHD and the control group in most of the activities that children engage in. More specifically, differences are observed in *playing video games* (U(54,51)=925, p=0.001 (0.39<0.78)), *reading or doing homework*, U(54,51)=352, p=0.000, (2.19>0.94), *discussing with family or friends*, U(54,51)=744.5, p=0.000 (1.30>0.59), *doing chores*, U(54,51)=511, p=0.000, (2.15>0.90), *playing with their toys*, U(54,51)=921, p=0.021, (0.98>0.41), *playing with their friends* U(54,51)=1055.5, p=0.021, (0.72>0.43), and *playing board games* U(54,51)=784.5, p=0.000 (1.20>0.51). A finding which must be noted is that parents report that their ADHD children seemed not to be distracted when they played video games, because the mean was 0.39 close to 0 which corresponds to never and slightly lower than the mean of the control group (0.78).

Table 5 reports findings related to symptoms of anxiousness/nervousness during engagement with electronic media. It must be noted that the ADHD group presents larger mean scores in all variables (apart from playing videogames) than the control group. Table 4 and 5 are similar suggesting an overlap in anxiety/nervousness and ADHD.

Table 5. Means (M), Standard Deviations (SD) and Mann-Whitney Test (U) Results About Anxiety/Nervousness Symptoms During Various Activities (N=105)

Anxiousness/nervousness	ADHD group (n=54)		Control group (n=51)		p
	M	SD	M	SD	
Playing video games	0.89	0.945	0.90	0.781	.674
Reading or doing homework	1.98	0.835	0.76	0.790	.000*
Discussing with family or others	1.48	0.885	0.80	0.693	.000*
Doing chores	1.72	1.123	0.82	0.767	.000*
Watching TV	0.50	0.863	0.47	0.703	.734
Playing with his/her toys	0.87	0.933	0.22	0.415	.000*
Playing on the computers	0.83	1.005	0.76	0.790	.923
Surfing on the internet	0.76	0.970	0.71	0.807	.953
Playing with his/her friends	1.09	0.853	0.61	0.666	.003*
Board games	1.26	0.828	0.61	0.695	.000*

p < 0.05

Differences are observed between ADHD group and the control group in the following variables: *reading or doing homework* U(54,51)=1315, p=0.000, *discussing*, U(54,51)=452.5, p=0.000, *doing chores* U(54,51)=787.5, p=0.000, *playing with their toys* U(54,51)=756.8, p=0.000, *playing with friends* U(54,51)=942.5, p=0.003 and *playing board games* U(54,51)=776, p=0.000.

It must be pointed out that the mean scores of children with ADHD is around 1.50, which corresponds to the answers "sometimes" and "often". In contrast, the mean scores of typically developing children are <1.00, that corresponds to "never" or "sometimes". It seems that children with ADHD are getting nervous or worried more often than typically developing children when they are engaged in various activities.

Table 6 presents findings regarding child's disorganization and absorption when playing videogames. As one can see, the ADHD group presents larger mean scores in all variables, with statistically significant differences from the control group in six variables concerning non technology-related activities [*reading or doing homework* $U(54,51)=381.5$, $p=0.000$], *discussing with family or others* $U(54,51)=635$, $p=0.000$, *doing chores* $U(54,51)=529.5$, $p=0.000$, *playing with toys* $U(54,51)=812.5$, $p=0.000$, *playing with friends* $U(54,51)=1057.5$, $p=0.025$, and *board games* $U(54,51)=751$, $p=0.000$].

Table 6. Means (M), Standard Deviations (SD) and Mann-Whitney Test (U) Results About Disorganization and Absorption During Various Child Activities (N=105)

Disorganization/absorption	ADHD group (n=54)		Control group (n=51)		p
	M	SD	M	SD	
Playing video games	1.11	1.144	0.98	0.761	.978
Reading or doing homework	1.94	0.878	0.63	0.692	.000*
Discussing with family or others	1.43	0.860	0.57	0.640	.000*
Doing chores	1.87	0.991	0.71	0.672	.000*
Watching TV	0.93	1.163	0.84	0.834	.688
Playing with his/her toys	0.96	0.823	0.37	0.528	.000*
Playing on the computers	0.98	1.141	0.75	0.796	.543
Surfing on the internet	0.94	1.123	0.71	0.807	.482
Playing with his/her friends	0.91	0.896	0.51	0.579	.025*
Board games	1.17	0.863	0.47	0.578	.000*

$p < 0.05$

Parental Concerns About Children Playing Videogames

This section explores parental concerns about video games and answers the fourth research question of the study. The mean scores of both groups are around 2.00-2.50, which means that parents worry "much" about their children engagement with video games. Statistical differences between the ADHD and the control group were observed only at a parental level of concern about the *absence of other interests due to video games* $U(54,51)=106.5$, $p=0.041$, ($2.44 > 1.90$) and *children's' distraction from school subjects* $U(54,51)=882$, $p=0.001$ ($2.70 > 1.80$).

Benefits of Video Games

Finally, with reference to the fifth research questions, we explored parents' views about possible benefits of videogames. Parents of ADHD children have a greater mean score in almost all variables than parents of typically developing children, which means that they have more positive attitude towards videogames than parents of children without ADHD. However, significant statistical differences between the two groups are revealed in *adaptation to everyday situation* $U(19,35)=1051.5$, $p=0.20$, ($1.02 > 0.51$), *maintaining attention* $U(54,51)=766$, $p=0.000$, ($2.30 > 1.16$), *memory skills* $U(54,51)=1011.5$, $p=0.016$, ($2.09 > 0.47$), *understanding* $U(54,51)=1072$, $p=0.043$, ($1.74 > 1.18$), *self-control* $U(54,51)=1029$, $p=0.017$, *coordination of hand-eye movement* $U(54,51)=923$, $p=0.003$ and *time management* $U(54,51)=956.5$, $p=0.004$.

Discussion

To our knowledge, this is the first study examining the pattern of video game and electronic devices use in children with ADHD in comparison with children of typical development in Greece. In the present study, longer time spent on video game playing, computer playing and surfing the web, particularly on weekdays, was observed in ADHD children compared to controls. However, both groups spent more time on such activities during the weekend, with no significant differences between the groups. This finding is in agreement with the study by Kietglaiwansiri and Chonchaiya (2018). A possible explanation is that school children with ADHD tend to prefer playing videogames on weekdays, rather than doing homework or sports which need self-control and attention. In addition, parents may find it difficult to prevent them from playing with the computer instead of doing their homework. At the weekends, all children are left under looser supervision by parents who do household chores or something else on their own, so children are expected to spend more time playing with electronic devices. A similar comment is made by Armendarez (2015) who found that in their free (leisure) time, youth with ADHD are not subject to weekday restrictions and supervision, so video game play exceeds the time recommended by the specialists.

With respect to the second research question who examined gender and age differences, gender hasn't been found to affect the time spent in video and computer games in this study although boys are found to play video games more often than girls and have more ADHD symptoms in the literature (Gentile et al., 2012; Kietglaiwansiri & Chonchaiya, 2018). A possible reason is that girls are fewer in number than boys in our sample so our finding is sample related. Moreover, age was found to play a significant role in influencing various child activities, whereby older children with ADHD (9-11 and 11-13 years) engage in media playing more often than younger children with ADHD (7-9 years). A similar pattern is observed in the control group but for a smaller number of activities. This finding is in line with research showing that the

factor of age must be considered when studying children's screen time. Adolescents seem to use more mobile phones and internet more than younger children. Moreover, there is a possibility that age is one cause for the association between video game use and ADHD behaviours (Armendarez, 2015). According to the literature, the consequences for younger children are more serious and the amount of time children spend watching TV, and playing is connected to quantifiable biochemical changes in their bodies and brains that could have an adverse effect (Beyens et al., 2018; Sigman, 2010).

Another finding emerging from the present study concerns the symptoms of inattention, anxiousness/nervousness and disorganization during various child activities, mainly at home (in relation to research question 3). Our study indicates that there are differences in the behavior of the two groups with ADHD children showing an increased level of anxiousness/nervousness and disorganization in activities such as reading or doing homework, doing chores, discussing or playing with friends. However, ADHD children seem to exhibit less ADHD symptoms when they play videogames. This finding is in line with Armendarez's (2015) parental endorsement that children demonstrated fewer ADHD behaviors during video game playing. It can be said that the type of activity and the motivation of the child affect the onset of ADHD symptoms. It is a possibility that ADHD students who are frequent video games players are less interested in activities such as homework, household chores, reading etc or conversely their attention and/or social difficulties may be the cause of their increased media involvement (Acevedo-Polakovich et al., 2007; Adelantando-Renau et al., 2019; Loiselle, 2015).

The fourth research question of the study refers to parental concerns about media use. Parents seem to express concerns about the time their offspring devote on media playing as well as the violent content of the games, the possibility of addiction and the lack of physical activity. Parents of ADHD children express more worries about their child's reduced interest in home or outdoor activities and schoolwork than parents of typically developing children. Parental concern is confirmed in our study but the fact that parents in both groups answered positively (between 'very often' and 'always') when they were asked if they exercise control over the time their child spent on video games playing. While children's electronic media playing time may be a matter of individual preference, parents must put the rules, monitor the type of games and evaluate the possible benefits and harms of media use. The recommendations of the Academy of Pediatrics about the time limits must be followed (Christakis, 2009; Sigman, 2010). Froiland and Davison's (2016) conclusion that "the home literacy environment (shared reading, children's books and library visits) is negatively associated with both fidgeting and hours of television seems to support the idea of enriching home literacy to reduce the risk of hyperactivity and ADHD symptoms" (p. 1349).

The next finding refers to possible positive effects of video games (research question 5). According to the literature, recent studies assess benefits for video game play within within cognitive, emotional and social domains with emphasis on the cognitive domain (Granic et al., 2014). In this study, parents of ADHD children and controls express a medium acceptance of the beneficial effects of video games on their children especially in maintaining attention, memory skills and hand-eye coordination. However, parents of children with ADHD evaluate video games more positively in social and cognitive areas such adaptation to everyday situations, maintaining attention, memory skills, understanding, self-control, hand-eye coordination and time management in comparison to parents of typically developing children. Our result is in line with other research but a key point to emphasize is that although children with ADHD may concentrate better on video games and show improvement in several skills, the frequent and daily use of video games eliminate the cognitive improvements which are not transferable to school or other subjects. Moreover, children who are frequent media players are prone to develop addictive tendencies or 'interruption resistance' (Chan & Rabinowitz, 2006; Tahiroglu et al., 2010).

Conclusion

The current study underlines the role of parents in monitoring the types and the time of computer and video games played by their children. The role of parents becomes crucial because they put the rules and the time limit on their children because of their age (Froiland & Davison, 2016). The perceptions of video games exhibited by parents are also important because they may influence children's video game use. Findings suggest that there are differences in perceptions and attitudes toward media use between parents of ADHD children and parents of typically developing children with the former being more anxious and concerned about their child's engagement with video games. As far as the connection between playing video/computer games and ADHD related problems, parents of ADHD children seem to support the idea that their children have greater difficulties in maintaining attention and interest in non-technology activities rather than video games in comparison to children with typical development. In addition, video games can have some benefits for ADHD children to stimulate the visual and auditory attention, but the findings are not yet clear under which conditions electronic media use have positive and transferable effects for ADHD children (Garagouni-Areou & Solomonidou, 2004).

Recommendations

The present study has a number of implications for parents, teachers and administrators. All the aforementioned groups would be interested in realizing the habits, time and preferences of media use by ADHD children and non-ADHD children, both for girls and boys, and how these factors influence their school progress and their status of attention, concentration and interest in different activities. The understanding of media use among ADHD and non-ADHD children can help us to make safe decisions about the use of technology in classroom and home interventions. In accordance with other research,

this study provides evidence that home-based parental involvement may be related to less inattention and a lower likelihood of ADHD symptomatology. Moreover, the present study can help parents and educators to early detect children with a tendency to devote most of their time in front of the screen.

A systematic series of well-designed empirical research on media use by children with ADHD will shed light on the important questions associated with the media-ADHD relationship. Another method is to administer a diary to children to keep track of their behaviours and media habits over the course of several weeks and compare this data with parents' information. In addition, it would be interesting to replicate this study with different subtypes of ADHD (hyperactive, inattentive and combined type) using parental and child measures.

Limitations

The present study has certain limitations. First, our cohort was small and within a wide range of children's ages (7-15 years old). ADHD cohort was recruited only from two organizations from Athens while the majority of control children were from Salonica. Fathers are also under-represented in the present sample. This creates threats for the generalizability of the results. Second, data were collected through a single questionnaire instead of a combination of quantitative and observational methods. Only with a more robust empirical base will we be able to comprehend the relationship between media and ADHD in its entirety.

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