COMPARING THE ELECTRONIC MEDIA HABITS OF ADOLESCENTS WITH ADHD AND ADOLESCENTS WITHOUT ADHD

by

Katherine Loiselle

A Thesis
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
The Requirements for the Degree
of
Master of Science
Educational Psychology

Committee:

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Date: _____ Spring Semester 2015
George Mason University
Fairfax, VA

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by

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Spring Semester 2015
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DEDICATION

I dedicate my work to my very patient fiancé, Glenn Østen Anderson.

ACKNOWLEDGEMENTS

Thank you to Dr. Anastasia Kitsantas, Dr. Lori Bland, Dr. Michelle Buehl, & Dr. Kristy Park for all of your guidance and expertise. Thank you to my family and friends for your love, encouragement, and support.

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ABSTRACT

COMPARING THE ELECTRONIC MEDIA HABITS OF ADOLESCENTS WITH ADHD AND ADOLESCENTS WITHOUT ADHD

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The main objective of this exploratory study is to compare the time in which adolescents with ADHD and adolescents without ADHD spend using electronic media (e.g., video games and watching television) and engaging in other activities (e.g. completing homework/studying, spending time with family, and spending time with friends), using The High School Longitudinal Study of (HSLS:09). The sample taken from the HSLS:09 included N=15,189 9th graders from over 900 public and private high schools. These 15,189 students made up the sample for the present study. Of the 15,189 students included in the sample, 7,600 (50.04%) students were male and 7,589 (49.96%) students were female. Additionally, 13,554 (89.24%) of students did not have ADHD, and 1,635 (10.76%) students did have ADHD. The amount of time these two groups of adolescents spent with families, with friends, and completing homework/studying was examined. Results indicated that the students with ADHD reported to play video games and watch television for more hours per school day than the students without ADHD. Additionally,

the students with ADHD reported spending less time with family than the students without ADHD. Furthermore, both samples watched television and played video games for larger amounts of time than they spent on homework/studying. These results have educational implications for students, parents, teachers, school administrators, and educational policy makers.

CHAPTER ONE

This thesis is about electronic media and children and adolescents with ADHD. It includes sections examining relationships between electronic media and children and adolescents with ADHD. After analyzing and comparing the research previously conducted in this area, I found a need for more research on how much time children and adolescents with ADHD spent using electronic media (Anderson & Pempek, 2005; Chan & Rabinowitz, 2006; Christakis et al., 2004; Gentile et al., 2011; Gentile et al., 2012; Gentile & Walsh, 2002; Stevens et al., 2009; Stevens & Mulsow, 2006; Swing et al., 2010; Vandewater et al., 2007; Zimmerman & Christakis, 2007). I examined questions asked of parents and students in the High School Longitudinal Study of 2009 (HSLS:09). Specifically, I look at questions on ADHD diagnoses and hours dedicated to electronic media (television and video games), homework, friends, and family. These questions were examined to compare the amount of time that adolescents with ADHD and adolescents without ADHD spent watching television, playing video games, with friends, with family, and completing homework/studying. The data were analyzed to examine the differences between these two groups.

Description of Problem

Children and adolescents are being encouraged by peers, celebrities, and advertisements to use various forms of electronic media. Children and adolescents (ages

8-18) watch television for an average of 4 hours and 29 minutes in a typical day and play video games for an average of 1 hour and 13 minutes per day in a typical day (Kaiser Family Foundation, 2009). Parents have reported that roughly 9.5% of children and adolescents (ages 4-17) have been diagnosed with Attention Deficit-Hyperactivity Disorder (ADHD) (Center for Disease Control and Prevention, 2010). The DSM-V reports that 5% of school-aged children have ADHD ([DSM-IV],APA, 2013). Because of these reports, medical and educational professionals have been researching possible causes, links, and solutions (Murray, Rabiner, & Hardy, 2011). Given the amount of time (a combined average of 5 hours and 42 minutes in a typical day) that children and adolescents spend with electronic media and the incidence of ADHD in the population of children and adolescents, I wondered how much time adolescents with ADHD, compared to adolescents without ADHD, spend using electronic media.

Definitions of ADHD. ADHD is defined as having, "[features including] hyperactivity, impulsiveness, and an inability to sustain attention or concentration. These symptoms occur at levels that cause significant distress and impairment and are far more severe than typically found in children of similar ages and developmental levels" (American Psychiatric Association, 2000, p. 1). Medical professionals have diagnosed children with ADHD, while students who exhibit "attention problems" have not been diagnosed by medical professionals. Instead, teachers or parents may have reported "attention problems". Students who are not diagnosed with ADHD, but who exhibit "attention problems" (as referenced in several studies), represent a separate population among children. The HSLS:09, the database used in this study, provided parents with a

questionnaire that asked them if their children had been diagnosed with ADHD by a doctor, heath care provider, teacher, or school official (Ingels et al., 2011). Since only doctors can diagnose ADHD, some parents may have reported unofficial "diagnoses" for their children. Still, this study focused on children whose parents reported diagnoses of ADHD, rather than reports of "attention problems."

Attention problems have been operationalized as having restlessness, impulsivity, obsessions, confusion, and difficulty concentrating. (Bioulac et al., 2008; Chan & Rabinowitz, 2006; Gentile, Swing, Lim, & Khoo, 2012; Swing, Gentile, Anderson, & Walsh, 2010; Tahiroglu, Celik, Avci, Seydaoglu, Uzel, & Altunbas, 2010; Zimmerman & Christakis, 2007). In one study, the percentage of children with attention problems at ages 1 and 3 were 10.4% and 9.6%, respectively (Christakis, Zimmerman, DiGiuseppe, & McCarty, 2004). Having children and adolescents with ADHD or attention problems lead researchers to look for associations with other variables. It is conceived that if researchers are able to find connections between such variables and attention problems, then medical and educational professionals might be able to design and provide appropriate interventions for students with ADHD (Stevens, Barnard-Brak, & To, 2009).

Many variables have been tested in studies to find associations between them and ADHD or attention problems. Some of these variables are related to the children/adolescents in the study: age (Anand & Krosnick, 2005; Vandewater, Bickham, Lee, Cummings, Wartella, & Rideout, 2005; Vandewater, Rideout, Wartella, Huang, Lee, & Shim, 2007) and Body Mass Index (BMI) (Chan & Rabinowitz, 2006; Stevens & Mulsow, 2006; Wack & Tantleff-Dunn, 2009). Other variables are based on the parents

in the study: parental involvement (Gentile & Walsh, 2002; Gentile et al., 2011; Sharif & Sargent, 2006; Stevens & Mulsow, 2006) and Socio-Economic Status (SES) (Gentile et al., 2012; Stevens & Mulsow, 2006; Vandewater et al., 2007). Some variables are based on the electronic media usage of the children/adolescents: television/video game exposure (Chan & Rabinowitz, 2006; Christakis et al., 2004; Gentile et al., 2012; Gentile et al., 2011; Stevens et al., 2009; Swing et al., 2010), limits on television/video game viewing (Anderson & Pempek, 2005; Gentile & Walsh, 2002; Stevens & Mulsow, 2006; Vandewater et al., 2007), and types of television programing (Zimmerman & Christakis, 2007). Electronic media was one recurring variable used in multiple research articles involving children and/or adolescents with ADHD.

Electronic media has fully infiltrated today's society, with television, video games, computers, music, and movies (Kaiser Family Foundation, 2005). An ample amount of research has been conducted to find associations between electronic media and children and adolescents. All of these articles could be placed into one of three categories. The first of these categories is electronic media may having associations with inattention in children (Christakis, et al., 2004; Johnson, Cohen, Kasen & Brook, 2007; Landhuis, Poulton, Welch, & Hancox, 2007; Stevens, Barnard-Brak, & To, 2009; Stevens & Mulsow, 2006; Zimmerman & Christakis, 2007). A second category is electronic media usage becoming possibly addicting to children and adolescents (Bioulac, Arfi, & Bouvard, 2008; Durkin, 2010; Gentile, Choo, Liau, Sim, Li, Fung, & Khoo, 2011; Sim, Gentile, Bricolo, Serpelloni, & Gulamoydeen, 2012). The final category is electronic media having possible beneficial outcomes for children and adolescents (Borger & Van

der Meer, 2000; Chuang, Lee, & Chen, 2010; Farrace-Di Zinno, Douglas, Houghton, Lawrence, West, & Whiting, 2001; Gulchak, 2008; Lieberman, Fisk, & Biely, 2009; Solomonidou, Garagouni-Areou, & Zafiropoulou, 2004; Sweetser, Johnson, Ozdowska, & Wyeth, 2012).

After reading about these three categories and encountering unanswered questions, I realized that more research needed to be completed in this field. These unanswered questions included: In what other activities do adolescents with and without ADHD engage? Do adolescents, with and without ADHD, spend the same amount of time on different activities, including electronic media? Are students with ADHD spending more time playing video games and/or watching television than they are spending completing homework/studying, with their friends, and/or with their family?

Because of these unanswered questions, I investigated comparisons between children and adolescents with and without ADHD and the amount of time they spent playing video games, watching television, completing homework/studying, with friends, and with family. I was curious to compare how these two groups spent their time at home because I believe it can shed light on their school performance. The results may lead to further research that compares students with ADHD and without ADHD, the amount of time they spend on these home activities, and their performance at school.

Definitions

ADHD is defined as having, "[features including] hyperactivity, impulsiveness, and an inability to sustain attention or concentration. These symptoms occur at levels that cause significant distress and impairment and are far more severe than typically found in

children of similar ages and developmental levels" (American Psychiatric Association, 2000, p. 1). Medical professionals have diagnosed children with ADHD; while students who exhibit medical professionals have not diagnosed "attention problems". Instead, teachers or parents may have reported "attention problems". Students who are not diagnosed with ADHD, but who exhibit "attention problems" (as referenced in several studies), represent a separate population among children.

Electronic media includes television, video games, computers, music, and movies (Kaiser Family Foundation, 2005). This literature review will focus on television and video games because more substantial research has been completed on these genres. Homework is defined as "tasks assigned to students by school teachers that are meant to be carried out during non-school hour" (Cooper, 1989, p. 7). Studying is the act of a student synthesizing information from various sources (teacher guidance, text books, notes taken during class, and/or online databases) to use as self-regulated learning (Winne & Hadwin, 1998).

CHAPTER TWO

The articles included in this literature review have focused on attention problems or ADHD, electronic media, or a relationship between attention problems or ADHD and electronic media. Although electronic media includes television, video games, computers, music, and movies, this literature review will focus on television and video games because more substantial research has been completed on these genres (Kaiser Family Foundation, 2005). The ample amount of research in these three genres may be due to their popularity among the public [Entertainment Software Association (ESA), 2013]. In 2012, $20.77 billion was spent on video/computer game content, hardware, and accessories (The NPD Group/Games Market Dynamics: US, 2012). Additionally, 43% of game players have reported feeling that video/computer games provide more value for their money than DVDs, music, or going to a movie theater (ESA, 2013). Likewise, children ages 2-11 watch an average of 24 hours of television a week and adolescents ages 12-17 watch 22 hours of television a week (Nielsen Company, 2012).

Method to Conduct the Literature Review

All of the articles I used for the literature review were published within the last fifteen years. I conducted electronic searching using the ERIC, JSTOR, and PsycINFO databases. The initial searches focused on finding articles with such keywords as, "video games" and "ADHD" or "attention problems." This limited the findings. Therefore, I

included the keywords, "television" or "electronic media," to broaden the field. To find research on the benefits of electronic media, I used the same educational databases, but searched using the keywords, "educational" or "positive" and "electronic media" or "television" or "video games." Additionally, I used the ERIC Thesaurus in order to find synonyms to these key words. I then checked the references of articles that I found for additional studies. Five studies fell outside of the 10-year time period (Borger & Van der Meere, 2000; Blum, Braverman, Seymour, & Chambers, 2000; Farrace-Di Zinno, Douglas, Houghton, Lawrence, West, & Whiting, 2001; Gentile & Walsh, 2002; Koepp et al., 1998). Nonetheless, these studies were included because other research referenced them as landmark research (see for example, Bioulac, et al., 2008; Bioulac, Lallemand, Fabrigoule, Thoumy, Philip, & Bouvard, 2012; Durkin, 2010; Gentile, et al., 2011) I critically reviewed the research on children and adolescents with or without ADHD and their interactions with television and video games. This reviewing included reading and analyzing the methods and results of each article to determine what findings and implications have already been established in this field. Then, I was able to create diagrams and charts to compare and contrast different groups of research to establish common themes. In reviewing the research I was looking for current theories in this field and a need for future research.

Relationships Between Children and Adolescents Watching Television and Attention Problems

The connections found between children watching television and subsequent attention problems are diverse. Given that six of the articles included in this literature

review refer to the research completed by Christakis et al. (2004), it was essential to thoroughly investigate their findings. Christakis et al. used two longitudinal data sets: the National Longitudinal Survey of Youth 1979 Children and Young Adults (NLSY-Child) and the National Longitudinal Survey of Youth 1979 (NLSY79). The sample consisted of children who were 7 years old during the 1996, 1998, or 2000 survey sets of NLSY-Child or NLSY79. Only 7 year-olds during these survey sets that had data from age 1 or age 3 were selected for the study (1,278 children at age 1 and 1, 345 children at age 3). The NLSY had previously administered the Behavioral Problems Index ([BPI], Peterson & Zill, 1986) to the 7 year-olds to monitor for hyperactivity. Within the BPI are six subscales to assess behavior problems: antisocial behavior, anxiousness and depression, headstrongness, hyperactivity, dependency, and peer conflict and social withdrawal. These subscales are adapted from the Child Behavior Checklist ([CBC] Achenbach & Edelbrock, 1981). The BPI included five questions asking if each child has difficulty concentrating, is easily confused, is impulsive, has trouble with obsessions, or is restless. Each question had three answers to choose from: often true, sometimes true, and not true. Then, the researchers created binary sub-scales (often true and sometimes true vs. not true) from the results of the five questions they calculated the sum. The resulting sub-scores were compared to national norms to determine percentiles and standardized scores. A binary classification representing attentional problems (present or absent) was created using a cut point of 120 on the same-gender standardized BPI Scale. Children receiving scores of 120 or more were 1.2 standard deviations (SD) above the mean. Although Christakis et al. (2004) admit that this is not equivalent to a medical professional

diagnosing a child with ADHD, they insisted that the symptoms they included were the same symptoms that a diagnosis of ADHD would have included. They go on to explain that they chose a cut-off of 1.2 SD or greater because it left them with a population comparable to published reports on the prevalence of ADHD (Wolraich, Hannah, Pinnock, Baumgaertel, & Brown, 1996). This cut-off score would be equivalent to 11% of the population being diagnosed with ADHD. The reliability of the subscale, though, was not provided. Additionally, Christakis et al. (2004) asked the mothers of the sampled students to identify the number of hours of television their children watched per day.

Using logistic regression models, Christakis et al. (2004) found that children who watched an amount of television that was one standard deviation above the mean [2.2 hours per day at age 1 (SD: 2.91) and 3.6 hours per day at age 3 (SD: 2.94)] had a 28% increase in the odds of having attention problems at age 7 (Christakis et al., 2004). The amount of time spent watching television increased by 1.4 hours between age 1 and age 3. Information on data from two and three standard deviations above the mean was not provided. Just looking at this research alone, without accounting for limitations, it may appear that there were connections between watching television at ages 1 and 3 and having attention problems at age 7. The limitations provided by the researchers included the lack of medical diagnoses of ADHD for the children, the potential inaccuracy of parental reporting, the fact that they could not draw any causal inferences from the relationship between television and later attention problems, and that this study did not make note of what the one year-olds and three year-olds were watching on television.

Two years after Christakis et al. (2004) published their study, Stevens and

Mulsow (2006) published their own to address the limitations in the first study: the methods used to identify a child as having attention problems, and the lack of emphasis placed on other variables that could be associated with attention problems (Stevens & Mulsow, 2006).

Different methods used to define ADHD. There was also a disagreement with the original methods used to define which children in the data sets had attention problems. "Easily confused" and "has trouble with obsessions" [two items used to label a child with attention problems in the Christakis et al. (2004) study] were not listed as symptoms of ADHD in the Diagnostic and Statistical Manual for Mental Disorders ([DSM-IV], American Psychiatric Association, 1994) (Stevens & Mulsow, 2006). Additionally, Christakis et al. (2004) labeled any child as a child with ADHD if their attention scores were 1.2 or more standard deviations above the mean. If this were a true representation of the country's population, then 11% of school-aged children would have been diagnosed with ADHD (Stevens & Mulsow, 2006). At the time of the Christakis et al. (2004) study, though, the percentage of school-aged children with ADHD was only 3% to 7% (American Psychiatric Association, 2000). Today, according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth edition (DSM-5), 5% of school-aged children have been diagnosed with ADHD ([DSM-5],APA, 2013). According to Stevens and Mulsow (2006), 11% seemed high and misleading. Since the operational definitions for symptoms of ADHD were different in Christakis et al. (2004) and Stevens and Mulsow (2006), the two studies were using two different parameters when including children in their sample populations.

Different variables. Stevens and Mulsow (2006) used structural equation modeling (SEM) to find possible relationships between symptoms of ADHD and other variables (television exposure, limits on watching television, parent involvement with the child, and socioeconomic status). Much of the data was gathered from the ECLS-K database. Television exposure was measured by a parental report of how many hours their children spent watching television on weekdays and how many hours their children spent watching television on the weekend. The researchers used three variables to measure parental limits on watching television. Parents answered yes or no to whether there were rules for: which television shows their children could watch, for how long the children could watch television, and how late their children could stay up watching television. Parental involvement with the child was measured by providing the parents with activities (e.g., reading, playing sports, singing, helping with art, playing games) and a frequency scale (not at all, once or twice a week, three to six times a week, and every day) that asked how often they participated in these activities with their children. Socioeconomic status was reported as two variables. The first variable was computed based on self-reports of the parents' income, parents' education levels, and prestige scores of the parents' jobs. The authors did not provide the manner in which the self-reported variables were combined to create the first variable. The second variable stated whether or not the family was below the poverty level based on Census information. Teacher and parent reports were used to define symptoms of ADHD. Teachers were asked to complete questions concerning the children's approaches to learning, self-control, and externalizing problem behaviors. Parents were asked to complete questions

concerning the children's impulsive/overactive behaviors. Data on ADHD or symptoms of ADHD were not included in the ECLS-K database. In order to collect data on symptoms of ADHD, Stevens and Mulsow (2006) created the Social Rating Scale (SRS) borrowing items from the Social Skills Rating System ([SSRS], Gresham & Elliott, 1990). Teachers and parents were asked to answer each of the questions using a frequency scale (never, sometimes, often, and very often).

The ECLS-K database consists of 22,000 children and families that are asked to provide information on school readiness, elementary school transitions, kindergarten experiences, the transitions to first grade, growth in cognitive domains, and growth in noncognitive domains. Two samples of 2,500 children were randomly chosen from the database. To find the goodness of fit between the first sample of 2,500 children and the second sample of 2,500 children, LISREL 8.52 was used. This model was successful and the researchers reported results from the first sample. There was a statistically significant association between only two of the variables, parent involvement with child and symptoms of ADHD (r =.07). This association was small and positive. There were no significant differences in the association between television exposure and symptoms of ADHD; the relationship was close to zero (r =.03) despite the large sample size (n = 2,500). There was a small, statistically insignificant association was found between limits on watching television and symptoms of ADHD (r =-.01). The limits-on-watching-television variable was removed from the model after it was found to be not statistically significant with ADHD. Additionally, there was a moderate-positive relationship between socioeconomic status and television exposure (r =.4) and a moderate-negative

relationship between socioeconomic status and symptoms of ADHD (r =-.34) (statistical significance was not discussed for either of these relationships).

Unlike Christakis et al. (2004), in this study there was not a significant association between television exposure and symptoms of ADHD (Stevens & Mulsow, 2006). The researchers speculated many reasons for this difference. First, the two studies looked at different variables. In fact, socioeconomic status was not even considered in the first study. This is especially important because there was moderate-negative relationship (r=-.34) between socioeconomic status and symptoms of ADHD. Also, Stevens and Mulsow (2006) referenced the difference in ages of the sample populations in their study (4 years old- 6 years old) and in the Christakis et al. (2004) study (1 year old and 3 year olds with effects shown at 7 years old). Stevens and Mulsow (2006) were examining students in one age range, but Christakis et al. (2004) were looking at effects 6 years and 4 years after watching television. Lastly, Stevens and Mulsow (2006) referred back to the limitation of varying measures of determining symptoms of ADHD. Stevens and Mulsow (2006) used the SRS to have parents and teachers answer questions about the students, but Christakis et al. (2004) used the data from the BPI's maternal survey. However, neither of these used children who had been diagnosed with ADHD by a doctor. Both studies were only relying on their interpretations of the symptoms of ADHD.

Different research questions. In another study conducted by Stevens et al. (2009), the researchers changed the research questions and method of the Christakis et al. (2004) and found different results (Stevens et al., 2009). These researchers used the same

database (NLSY-79) as Christakis et al. (2004), but they used different research questions. The first research question simply asked about the television viewing habits of children ages 4-10 and their attention and hyperactivity levels. During the 2000 wave of the NLSY-79 all of the children were 4 years old. The authors never explained why 4 years old was chosen to be the starting point. The researchers then collected data from the 2002, 2004, and 2006 waves when the children were 6, 8, and 10 years old, respectively. The second research question compared the relationship between the television viewing habits and the attention and hyperactivity levels of the children (Stevens et al., 2009). In order to answer these research questions, the researchers looked at the Behavior Problems Index (BPI) given to the mothers in the NLSY-79 database. Within the BPI are six subscales to assess behavior problems: antisocial behavior, anxiousness and depression, headstrongness, hyperactivity, dependency, and peer conflict and social withdrawal. These subscales are adapted from the Child Behavior Checklist ([CBC] Achenbach & Edelbrock, 1981). Mothers were asked to answer every question by using a frequency scale from 0 (did not notice this behavior at all) to 5 (the mothers saw a "high degree" of this behavior; Stevens et al., 2009).

After the research was complete, they found that initially (ages 4 and 5) television viewing and ADHD symptoms had a positive correlation (Stevens et al., 2009). At these earlier ages, Stevens et al. (2009) found a positive correlation between the amount of television a child (ages 4 or 5) watched and their level of inattention. Between the ages of 6 and 8, though, Stevens et al. (2009) found that ADHD symptoms began to decrease and television viewing began to plateau. They inferred a possible relationship between a

child's age and his or her television viewing habits, attention, and hyperactivity level. Initially, the two variables appear to increase at a similar rate between the ages of 4 and 6. Simply looking at the earlier stages of the longitudinal study's data would make the reader believe that there is a positive correlation between the amount of television watched by a child and his or her inattention. Between ages 6 and 8, though, television viewing stabilized and inattention and hyperactivity began to decline. Thus, looking later in the longitudinal study's data one would find a weak or possibly negative correlation between the two variables (Stevens et al., 2009).

This information allowed Stevens et al. (2009) to hypothesize the reasoning for the different findings in Christakis et al. (2004) and Stevens and Mulsow (2006). Christakis et al. (2004) were looking at the two variables (television viewing and attention problems) at an age range when they were both increasing. Stevens and Mulsow (2006), though, were looking at the two variables (television and inattention and hyperactivity) at an age range (4 and 5 years) when inattention and hyperactivity were beginning to decrease, according to Stevens et al., 2009. From this information, it was clear to Stevens et al. (2009) that one of the reasons for such different results between Christakis et al. (2004) and Stevens and Mulsow (2006) was due to the different age groups used by the two research groups. This confirmed the need for more research in this area since no two studies confirmed another's findings.

Other studies also used the findings of Christakis et al. (2004) and Stevens and Mulsow (2006) to guide their study. A longitudinal study completed by Landhuis et al. (2007) focused on the amount of television children watched at ages 5, 7, 9, and 11 years

to compare it to self-, parent-, and teacher-reported attention problems at ages 13 and 15 years. They referenced Christakis et al. (2004) and Stevens and Mulsow (2006) in order to make the points that associations between television and children are scant and fail to show if the associations/relationships they find continue beyond the age ranges studied. Their research question asked: is there a long-term association between the amount of time children watch television and later attention problems when they are adolescents? The sample population consisted of children born between April 1972 and March 1973 in Dunedin, New Zealand. Participants were assessed every 2 years up until the age of 15 and again at ages, 18, 21, 26, and 32 years. The hypothesis was that children who watched more television (3 hours or more a day) at ages 5, 7, 9, and 11 years may have more attention problems at ages 13 and 15 years. It was found that an average of 2.05 hours (SD = 0.83) of television were watched on the weekdays by children between the ages of 5 and 11 years. There was an increase of over an hour between ages 13 and 15 since they watched an average of 3.13 hours (SD = 1.43) of television on the weekdays. A significant correlation was found between hours of television watched in childhood years and in adolescent years ($r = 0.39$; $p<.01$). There was also a significant correlation between attention problems in childhood and attention problems in adolescent years ($r=.44$; $p <.01$) (Landhuis et al., 2007). Controlling for gender differences, early inattention problems, socioeconomic status, and cognitive ability, the hypothesis of Landuis et al. (2007) was supported. Thus, finding that children who watched 3 more or hours of television a day at ages 5, 7, 9, and 11 years may have attention problems at ages 13 and 15 years. This study added a different set of findings for yet another age range.

The previously mentioned studies all included age ranges in childhood, but none of them focused primarily on adolescent age ranges. Johnson et al. (2007) were interested in the attention difficulties in adolescents in relationship to their television usage. In this study, the researchers were interested in the amount of television watched by adolescents at the mean age of 14 years and their attention problems at 16 years old. They hypothesized that television viewing time during childhood and adolescence may be associated with subsequent attention problems. Even though they did not include a childhood age, they did ask adolescents with a mean age of 14 how many hours of television they watched per day. Similarly to Landuis et al. (2007), Johnson et al. (2007) found that adolescents who watched 3 or more hours of television a day were more likely to have frequent attention problems later in adolescence. These researchers were focused on the number of hours spent watching television. However, none of them focused on the type of television programming being watched by children and/or adolescents.

In the aforementioned studies, the type of television viewing was not used as a variable. More recent research explored the possibility that it may matter what the children are watching: shows categorized as educational, providing non-violent entertainment, or having violent content (Zimmerman & Christakis, 2007). One of the research questions used by Zimmerman and Christakis (2007) was related to a possible association between early television viewing and subsequent attentional problems and the type of television content being viewed. Their other research question asked about whether or not the first 3 years of life was a more critical age range than other age ranges for having vulnerabilities to the effects of electronic media (Zimmerman & Christakis,

2007). These researchers used the Panel Survey of Income Dynamics ([PSID], National Science Foundation, 1968) with the Child Development Supplement ([CDS], National Institute of Child Health and Human Development, 1997). The questionnaire used to derive data for this study included demographic data, psychological and behavioral information on parents and children, and diary data (including primary and secondary activities for each of the two 24 hour periods). Children, who started the longitudinal study at ages younger than five and had follow-up data from five years later, were chosen for the Zimmerman and Christakis (2007) study. The PSID also includes the BPI with a hyperactive scale. This scale includes questions on: concentration, impulsivity, confusion, obsessions, and restlessness. Parents were asked to respond one of three ways: not true, sometimes true, and often true (1, 2, and 3, respectively). The types of television being watched by the children were found through looking at the daily diaries. From there, each television show watched was coded as one of three types of television: educational, nonviolent entertainment, and violent entertainment. They found no association between children before age 3 watching educational television and attention problems 5 years later (OR = 0.64, 95% CI: 0.32-1.28, p= .21). They also found that there was no association between children ages 4 to 5 watching any type of television and attention problems 5 years later. However, when children viewed television shows classified as non-violent entertainment (OR = 1.73, 95% CI: 1.02-2.94, p= .04) or having violent content (OR = 2.20, 95% CI: 1.19-4.08), p= .01) before the age of 3, a significant association appeared. More specifically, they found that an average of one hour of violent television watching per day doubled the likelihood of a child having attention

problems 5 years later.

According to these four articles, one could infer that the association between television viewing and attention problems in children is dependent on the age of the child. It could also be inferred that the association between television viewing and attention problems in children is also dependent on the type of television being watched, according to Zimmerman and Christakis (2007). The most significant positive correlation between television viewing and inattention was identified for children younger than three watched non-educational television shows (Zimmerman & Christakis, 2007).

Connections Among Children Playing Video/Computer Games and Attention Problems

Increased play of video games, another type of electronic media, may show a connection with attention issues in children and adolescents (Chan & Rabinowitz, 2006; Swing et al., 2010). The video games that these studies refer to include console (Nintendo, Sony Playstation, etc.) video games and Internet video games. Swing et al. (2010) referenced the study completed by Zimmerman and Christakis (2007) in an effort to suggest that educational video games may have a different association with ADHD behaviors than non-violent entertainment or violent video games. In order to find a possible relationship between playing video games and symptoms of ADHD, Chan and Rabinowitz (2006) compared the use of Internet, television, console video games, and Internet video games with Body Mass Index (BMI), behavioral symptoms [scores on Young's Internet Addiction Scale and Connors' Parent Rating Scale (oppositional,

inattention, hyperactivity, and/or ADHD behaviors)], and academic performance (overall grade point average and last grades in math and english) in ninth and tenth grade students. These variables were chosen because, according to Chan and Rabinowitz (2006), other studies have reported associations between television viewing and attention disorders, obesity, and school performance. However, there was a significant increase in the amount of inattention and ADHD behavior in adolescents who played video games for 1 hour or more a day. Additionally, there was a significant difference in the overall grade point averages (GPA) between students who play video games for less than an hour a day and students who play video games for an hour or more a day for students who played video games for 1 hour or more a day (< 1 hour with console video games: M = 3.67, ± 0.34, $p = 0.02$; ≥ 1 hour with console video games: M = 3.00, ± 0.76; < 1 hour with internet video games: M = 3.67, ± 0.36, $p = 0.01$; ≥ 1 hour with internet video games: M = 3.00, ± 0.701). Even though ADHD behaviors and video games seem to have an apparent association, it was cautioned that Chan and Rabinowitz (2006) were not sure if playing video games for an hour or more a day lead to an adolescent exhibiting ADHD behaviors or if adolescents who exhibit ADHD behaviors play video games for longer periods of time than their counterparts without ADHD (Chan & Rabinowitz, 2006). However in this study, trends found between an adolescent's BMI and the amount of time they spend on the Internet, watching television, or playing video games were not significant.

Possible reasons for association. Gentile et al. (2012) hypothesized that there were four possible reasons for the association between video game usage and ADHD

behaviors. The first possibility was there could be an entirely different variable (gender, age, socioeconomic status, etc.) that was the cause for the association between video game usage and ADHD behaviors. According to the researchers, "[another] possibility is that the observed association between electronic media and attention problems is spurious. A third variable such as sex may explain this association" (Gentile et al., 2012, p. 63). Secondly, they thought it was possible for students who were frequent video game players to lose interest in other activities (schoolwork, homework, etc.) that were not as visually or physically stimulating. Thirdly, adolescents who play video games for long periods of time may be missing out on activities that would allow for growth in impulse and attention control. The final possibility, similarly to Chan and Rabinowitz (2006), was that adolescents with ADHD behaviors might just like to play video games more than their peers without ADHD. This is because, "those with lower self-control may find the appeal of exciting electronic media too difficult to resist" (Gentile et al., 2012, p. 63). It was also found, similarly to Chan and Rabinowitz (2006), that the amount of time spent playing video games was the best predictor for attention problems (Gentile et al., 2012). Gentile et al. (2012) found video game playing to have a bidirectional causality with attention problems. Gentile et al. (2012) claim that their findings show children who play video games for more time have more attention problems (r = .05), and children with attention problems play video games for more time (r = .10). They also found video game playing to have a bidirectional causality with impulsiveness. Gentile et al. (2012) claim that their findings show children who play video games for more time have more impulsiveness (r = .05), and children with more

impulsiveness play video games for more time (r = .07). Thus, the largest predictor was the total time spent playing video games compared to attention problems and impulsiveness. They used these findings to conclude that their third hypothesis was found to be the most true- children who played a large amount of video games were spending less time on other activities that may allow for a greater development of impulse control.

Comparing children with ADHD to peers. Although many studies in this area involve only using children with ADHD, others were interested in comparing children with ADHD to children without ADHD. Other researchers discussed the possibility of children with ADHD performing at the same level as their peers (without ADHD) on some video games, but performing worse than their peers (without ADHD) on other video games (Bioulac, et al., 2012; Shaw, Grayson, & Lewis, 2005). The reasoning behind this research was the fact that many parents of children with ADHD reported their children having a much longer attention span and greater concentration while playing video games (Shaw et al., 2005). Studies were conducted so that children with ADHD and children without ADHD played different types of video games (Shaw et al., 2005; Bioulac et al., 2012). Some of the video games were commercially available to the public. These games usually had fun graphics and characters. The other video games had more basic layouts. All of the games were set to measure the impulse control, attention, and concentration of the children. Both of the studies found that the children with ADHD performed at that the same level as their peers without ADHD on the games with the fun graphics and characters. Both studies also found that the children with

ADHD performed significantly lower than their peers without ADHD on the video games with the more basic layouts.

From these two studies, it can be inferred that some video games are more attractive to children with ADHD than other video games. Furthermore, it seems that children with ADHD would be more likely to play video games that have more visually appealing layouts. If one refers to the definitions of ADHD, hyperactivity, and impulsivity, it would make sense that children who suffer from short attention spans are more attracted to something more visually appealing. Perhaps, it's the attractive visuals that make the children with ADHD more interested.

The Possibility of the Addiction to, or Pathological Use of, Electronic Media

The concept of children with ADHD having a greater attraction to electronic media is addressed in Bioulac et al. (2008), Durkin (2010), and Gentile et al. (2011). These three articles cite important research completed by Koepp et al. (1998) concerning evidence that dopamine is released in the brain while playing video games. This evidence is reinforced in an article edited by Blum et al. (2000) on the Reward Deficiency Syndrome. This syndrome refers to people who are not as satisfied with "natural rewards" (e.g., feelings of love, enjoyment of eating) as others (Blum et al., 2000). Typically, "natural rewards" release dopamine in the brain to make a person feel satisfied. Because of this void, people with the Reward Deficiency Syndrome seek satisfaction through "unnatural rewards." Some examples of "unnatural rewards," given by Bioulac et al. (2008), are alcohol, cocaine, gambling, and other risk-taking behaviors. Bioulac et al. (2008) goes on to infer that video games may be another "unnatural

reward" that gives the feeling of satisfaction.

The study completed by Gentile et al. (2011) begins to explain the connection between the Reward Deficiency Syndrome and children with ADHD. A two-year longitudinal study was conducted to analyze pathological game use among children. Officially, the American Medical Association (AMA) does not recognize addiction of video games or other electronic media sources (AMA, 2007). However, In order to determine which children could be classified as "addicted" to video games, Gentile et al. (2011) used the definition of pathological gambling behaviors in the DSM-IV to define pathological gaming ([DSM-IV],APA, 1994). The criteria adapted from the diagnostic criteria for pathological gambling included: a preoccupation with the medium, repeated and unsuccessful attempts to quit, feeling restless or irritable when quitting was attempted, using the medium as a way to escape a negative mood, lying to family members or friends about using the medium, committing illegal acts in order to use the medium, jeopardizing or losing a job or social relationship, relying on other people to support the use of the medium, taking larger risks to obtain higher levels of excitement, and trying to make-up for past losses (APA, 2000). Teachers gave their students surveys that asked about their amount of: gaming, social competence, impulsivity, family relationships, symptoms of depression, social phobia, and anxiety. Gentile et al. (2011) found that children and adolescents who are impulsive, have lower social competence, and empathy, and have lower emotional control are more likely to have pathological gaming issues. They inferred that since the impulsivity is one of the main components of ADHD, children with this disorder might be more likely to be pathologically "addicted"

to video games. Children had to meet one half of the requirements, according to the APA's definition of pathological gambling, to be deemed pathologically addicted to games. According to Merzenich in Bavelier, Green, Han, Renshaw, Merzenich, and Gentile (2011), approximately 1 in 5 regular video game players appear to meet the criteria that would define them as "addicted." The word "addicted," obviously has negative implications due to the criteria by which it is defined: withdrawal symptoms, loss of control, attempts to stop, continued use despite known consequences, and increased tolerance (APA, 2000). However, some researchers are still not convinced that all video games have negative effects. In fact, some researchers address the possible benefits of children using video games.

Benefits of Video Games for Children and Adolescents with Attention Problems

There is no conclusive evidence of an association between children and adolescents watching television or playing video games and having attention issues. The proof that youth with attention problems should limit the amount of electronic media in their lives is simply not strong. There may be other factors contributing to a possible association between youth having attention issues and watching television or playing video games. This is shown in one of the previously mentioned articles, Chan and Rabinowitz (2006), when they concluded that children who play video games for long periods of time may be missing out on activities that would allow for growth in impulse and attention control. This is contrary to hypothesis stating children with inattention are seeking video games or that video games make children less interested in other activities (Gentile et al., 2012). Because of this, it seemed necessary to explore possible benefits

of electronic media for children with attention problems.

An experimental study hypothesized that certain video games can stimulate the visual and auditory attention of children with ADHD (Chuang, Lee, & Chen, 2010). The researchers hypothesized that the goal-oriented nature of certain video games, with rewards and consequences, would lead to children with ADHD being able to control their own behavior in the form of attention (Chuang, Lee, & Chen, 2010). These beliefs coincide with the opinions stating that video games allow for students to have rule-based challenges that provide feedback for success towards a goal (Lieberman et al., 2009; Sweetser et al., 2012).

This goal-oriented nature of video games has also been used as a means to instruct children. One quasi-experimental study, Solomonidou et al. (2004), used educational software with visuals and sound bytes to determine which computer software's instruction methods were the most effective for children with ADHD. While direct instruction through a computer is different from a computer video game, the medium is the same. The researchers found that children with ADHD were most attentive and learned the most material with software that used photographs and video clips with short narratives. On the contrary, children with ADHD were the least attentive and learned very little material with software that only included long texts and long videos without narration. The researchers inferred that children with ADHD learned more from computer software that uses photographs and video clips with short narratives. Since these children have short attention spans (due to the ADHD), they would be more likely to watch a greater percentage of a narrative if it is short (Solomonidou et al., 2004). This

is consistent with other research that suggests when tasks are attractive to, or engaging for, children with ADHD they will be able to sustain their attention for longer periods of time (Borger & Van der Meer, 2000; Farrace-Di Zinno et al., 2001). It seems clear that children with ADHD will be able to pay attention longer during a short, visually-appealing task.

Similar studies were conducted to see the benefits of a student with attention problems or ADHD using one type of electronic media. In one study, the researchers used non-specified reading applications on an iPad to help a struggling reader with ADHD. The child was able to increase his reading level by an entire school year in just six weeks of using the reading applications on the iPad with an undergraduate student's assistance (McClanahan, Williams, Kenney, & Tate, 2012). The researchers do admit that it may appear that one-on-one instruction, not the iPad, may have been the cause for the student's acceleration. They argue, though, that the first sessions with the instructor were one-on-one without the iPad, and the student really struggled to pay attention and make growth. Once the iPad was introduced, his attention seemed more focus and more progress was made (McClanahan et al., 2012). In another study, Gulchak (2008) used a handheld computer to teach a student how to self-monitor his attention. The student would do this by tracking his ability to keep his hands away from his face, complete work assigned, and raise his hand to ask questions every 30 seconds for 30 minute sessions. In the end, the student decreased the amount of time his hands where by his face, increased the amount of work he completed, and increased the number of times he raised his hand to ask a question. Since these were the defining points of his attention, the researcher

suggested that self-monitoring his attention helped to increase it (Gulchak, 2008).

These studies on the benefits of electronic media on children with ADHD all have one common thread: each electronic media source was chosen by the researchers to help children. It seems apparent educational computer software and reading applications all have a purpose to improve the social or academic behaviors of the children using them. The studies were structured in a way that allowed the children to be successful. When focusing on these two studies, Solomonidou et al. (2004) and McClanahan et al. (2012), it is clear that these students with attention problems were more successful when learning through electronic media sources with short and interactive lessons. No one in these studies questioned these students' video gaming and television viewing habits. Alternate explanations could conclude that if their learning styles had been adjusted to short, interactive, and stimulating videos due to extensive video game playing and/or television watching, then they may be more be more successful when learning with short, interactive, and stimulating activities.

Additional Positive Aspects of Electronic Media for Students Without ADHD

There is a large amount of research on the benefits to using electronic media with all children (in general, not specified to children with ADHD or another disorder). The majority of these articles fall into two categories: using electronic media in the classroom as active and motivating learning tools or using electronic media to resource to help students design their own video/computer games.

Three articles explained the importance of using active gaming in the general or physical education classroom (Hansen & Sanders, 2010; Russel & Newton, 2008;

Sweetser, Johnson, Ozdowska, & Wyeth, 2012). Active gaming allows children to participate in video games while being physically active. Some examples of video game systems that allow for active gaming are the Nintendo Wii™, Sony PlayStation Move™, and the XBOX Kinect™. The children simply think they are playing video games, when really they are exercising as well (Hansen & Sanders, 2010; Russell & Newton, 2008). This is much different than the sedentary, passive video games of which most people are familiar (Sweetser, Johnson, Ozdowska, & Wyeth, 2012). One study describes children being so intrinsically motivated by participating in these active video games, that they become fully immersed in completing the games' goals (Hansen & Sanders, 2010).

This intrinsic motivation is not limited to just active games, but also to "serious games" (educational games) (Michael & Chen, 2005 as referenced in Petrov & Rogers, 2011, p.8). Students are no longer interested in listening to a teacher lecture about a certain topic. They now want to see the teacher take on a role as a coach, as the video/computer games help facilitate the learning (Petrov & Rogers, 2011). They do this by only reinforcing correct learning and by providing helpful feedback when students are misguided (Klopfer, Sheldon, Perry, & Chen, 2012; Petrov & Rogers, 2011; Simpson & Clem, 2008; Tuzun, 2007).

In the area of game design, adolescents are using their technological motivation to design their own video games for learning (Clark & Sheridan, 2010; Khalili, Sheridan, Williams, & Clark, 2011). When students are asked to design their own video games, it requires them to be metacognitive about the concepts and elements of the games (Clark & Sheridan, 2010). In both studies, the researchers found that particular students strived at

showing their ability to question, own, and articulate their own knowledge (Clark & Sheridan, 2010; Khalili, Sheridan, Williams, & Clark, 2011).

Adolescents and Time

Though it was very important to find research on the interactions between children and adolescents and electronic media, it seemed imperative to gather information on other activities in which children and adolescents participated. Through looking at research involving activities completed by students outside of school, three areas seemed to be the more prevalent: time spent on homework/studying, time spent with family, and time with friends. These three areas, and their relationships with children and adolescents, are discussed below.

Homework/studying. Homework is defined as: anything assigned to students, by teachers, to be completed at home (Cooper, 1989). Studying is the act of a student synthesizing information from various sources (teacher guidance, text books, notes taken during class, and/or online databases) to use as self-regulated learning (Winne & Hadwin, 1998). Numerous studies have been conducted to determine the optimal amount of homework for children and adolescents (Cooper, 1989; Cooper, Robinson, & Patall, 2006; Cummings & Vandewater, 2007; Lam, 1996). Cooper (1989) was landmark research on homework and has been a source of comparison for other research (Cooper, Robinson, & Patall, 2006; Cummings & Vandewater, 2007; Lam, 1996). Cooper (1989) found a linear relationship between homework and achievement when high school students spent between 1 hour and just over 2 hours a day (the highest measured interval in this study) on homework. Conversely, a linear relationship between homework and

achievement was found only when junior high students spent less than an hour a day on homework. Because of these relationships, Cooper (1989) recommended that high school students receive 1-2 hours of homework a day and junior high school students receive less than 1 hour of homework a day. Similarly, Lam (1996) found the strongest relationship between homework and achievement in Caucasian American and Asian American high school students when they completed 7 to 12 hours of homework a week. Lam (1996) suggested that the optimal time spent on homework by a high school student is 1 ½ -2 ½ hours.

Cummings and Vandewater (2007) completed research to determine if the amount of time adolescents spent on video games was taking away from other activities, like homework. There were 1,491 children (10-19 years old) who were chosen from the Panel Study of Income Dynamics- Child Development Supplements to keep 24-hour diaries. The researchers randomly chose 1 weekday and 1 weekend day from each child to calculate the amount of time spent on different activities (homework, video games, time with friends, time with family members, reading, and sport activities). The researchers found that gamers (students that play video games) spent less time doing homework on the weekends and weekdays than nongamers (students that do not play video games). It was also shown that there was a difference between boys and girls when comparing video game play and homework. There was no significant relationship ($\beta = -0.04$) between video game play and homework on weekends or weekdays for boys. For girls on the weekdays, though, for every 1 hour spent playing video games, they completed 13 minutes less (a 34% decrease; $\beta=-0.21$; $P<.01$) of homework (Cummings &

Vandewater, 2007). According to this study, boys were spending an average of 38.49 minutes (SD = 53.51) on homework on a weekday and spending an average of 11.75 minutes (SD = 36.89) on homework on a weekend day. Girls were spending an average of 36.43 minutes (SD = 52.22) on homework on a weekday and spending an average of 9.38 minutes (SD = 29.12) on a weekend day. Since this study consisted of students between the ages of 10 and 19 (elementary, middle, and high school ages), it's difficult to determine whether or not these students were completing the recommended homework amount as described by Cooper (1989) and Lam (1996), less than 1 hour for junior high school students and 1-2 ½ hours of homework a school night for high school students. In terms of Cooper's (1989) and Lam's (1996) recommendations for high school students, all of the averages are too low. However, the averages do fall into the appropriate range for the recommended amount of homework for junior high school students (Cooper, 1989).

In conclusion, the students in this study who were gamers were spending under 40 minutes (37.74 minutes) on homework each school night. Since the age range was 10-19 years, some of the students were in junior high school and some are in high school. Because of this, 37.74 minutes on homework was within Cooper's (1989) recommended time range (less than an hour) for students in junior high school. However, 40 minutes would be too low for the students in this range who were in high school. This was much lower than the 1–2 ½ hour range recommended by Cooper (1989) and Lam (1996). Non-gamers, on the other hand, completed homework for an average of 56.40 minutes per school night. This number of minutes was still within Cooper's (1989) junior high school

range and much closer to Cooper's (1998) and Lam's (1996) high school recommendation. Homework recommendations aside, non-gamer students were spending a significantly higher amount of time on homework than their gamer peers.

Family and friends. Cummings and Vandewater (2007) also included time spent with family and time spent with friends in their study. Again, they were looking to see if playing video games offset the amount of time students (10-19 years old) spend with their families and friends. On the weekend days, there was a relationship between boys who spent more time playing video games without their parents and spending less time with their parents at other times. The same was true for girls on the weekends. The coefficients represent a 13-minute (6%) decrease for boys and a 35-minute (26% decrease for girls) (Cummings & Vandewater, 2007). It was also found that the boys and girls who spent more time playing video games on the weekend spent less time with friends in other activities. Although relationships were found, the researchers noted that causal relationships cannot be formed given that they can't prove the direction of the effects. This research shows that children spending more time playing video games are spending less time with friends in other activities.

In terms of time with family, one report showed that some children are spending time with electronic media and their parents at the same time. Rideout, Hamel, and Kaiser Family Foundation (2006) conducted a report to gather information on the usage of electronic media by infants, toddlers, preschoolers, and their parents. They found that many parents value time spent with their children while using some form of electronic media. One part of this report stated the percentage of parents who use electronic media

with their children all or most of the time: 68% for television, 50% for computers, and 38% for video games (Rideout et al., 2006). These percentages mean that some parents are spending time with their children while they watch television, use computers, or play video games. This time, therefore, could count as time with family and time with electronic media.

One report actually showed that the more hours spent with electronic media, the more time they spent with their parents and friends. Roberts, Foehr, and Rideout (2005) conducted a similar report with 8- to 18-year olds. Students were categorized into three groups depending on how much time they spent with electronic media each day: low (3 hours or less), moderate (3+ through 13 hours), or high (more than 13 hours). Representing 18% of the sample, the low group spent the least amount of time with their parents, on average 1 hour and 57 minutes. With 62% of the sample, the moderate group spent, on average, 2 hours and 16 minutes with their parents. The high group, representing 20% of the population, spent the most amount of time with their parents, 2 hours and 35 minutes (Roberts et al., 2005). When looking at just the 7^{th}-12^{th} graders in the original sample of 8- to 18-year olds, the researchers asked the students to report the amount of time they spend hanging out with friends each day. Representing 16% of the sample, the low group spent, on average, 2 hours and 11 minutes with friends. With 64% of the sample, the moderate group, on average, spent 2 hours and 10 minutes with friends (just one minute less than the low group). The high group though, representing 19% of the sample, on average spent 2 hours and 41 minutes with their friends. In both samples, the 8- through 18-year olds and the 7^{th}-12^{th} graders, the students who used electronic

media for three or more hours a day actually spent more time with parents and friends (Roberts et al., 2005). From these results, the authors concluded that engaging in electronic media for longer periods of time doesn't necessarily take away time from other activities, like spending time with parents or friends.

Cummings and Vandewater (2007) and Roberts et al. (2005) seem to have somewhat conflicting findings. Cummings and Vandewater (2007) found the more a child/adolescent spent using electronic media, the less time they spent with their friends in other activities. On the other hand, Roberts et al. (2005) found that children/adolescents who spend over three hours with electronic media spend more time with their friends. What Roberts et al. (2005) does not clarify, unlike Cummings and Vandewater (2007), is whether or not they are including time spent with friends within that three hours or more spent with electronic media. In other words, the children/adolescents may be spending all of their time with friends while they are using electronic media. The children/adolescents could either be spending time with friends strictly while using electronic media, or they could be using electronic media for three or more hours and spending additional time with friends. If the former is the case, then the children are not really spending time with friends do other activities.

Need for Further Research

All of the previously reviewed studies had one very important limitation. This limitation is the fact they have not conducted any experimental research. None of the aforementioned articles were able to show that electronic media causes children to develop symptoms of ADHD. Conversely, none of the aforementioned articles were able

to show the electronic media did not cause children to develop symptoms of ADHD. This is because, ethically, none of the researchers are able to knowingly expose children to harmful television or video games. Of course, no researcher would find a harmful television show or video game to show a toddler in order for a study to show that later in that toddler's life there were subsequent attention problems. Because of this, it was impossible to show a causal relationship for these studies (Christakis & Zimmerman, 2009). This limitation is just one of the reasons why there is no consensus on this topic.

The surveys given in almost all of the studies lead to the next limitations. Since surveys rely on people being accurate and telling the truth, there is always room for human error on a survey. For example, some of the parents and/or teachers who filled out inattention and hyperactivity surveys for the children could have answered incorrectly. This could possibly mean that parents incorrectly identified their child's attention problems or ADHD diagnosis.

Conclusions

In order to analyze the research and draw conclusions, one must look across the studies attempting to find associations between television/video games and attention, and the studies attempting to find benefits of electronic media for children with attention problems. There seems to be one glaring difference between these two different types of studies, though. The issue of choice differentiates the two groups of studies. The first group of studies focus on the television shows and video games that children are choosing to watch (Chan & Rabinowitz, 2006; Christakis et al., 2004; Christakis & Zimmerman, 2009; Cummings & Vandewater, 2007; Gentile et al., 2012; Johnson et al.

(2007); Landuis et al., 2007; Stevens & Mulsow, 2006; Stevens et al., 2009; Swing et al., 2010). The latter studies focus on electronic media that is chosen and regulated by the researchers (Borger & Van der Meer, 2000; Chuang, Lee, & Chen, 2010; Farrace-Di Zinno et al., 2001; Klopfer et al., 2012; Lieberman et al., 2009; McClanahan et al., 2012; Petrov & Rogers, 2011; Simpson & Clem, 2008; Solomonidou et al., 2004; Sweetser et al., 2012; Tuzun, 2007). When significant associations were found between electronic media and attention issues, they involved children choosing to watch violent or non-educational television, or video games. When benefits were found between electronic media and attention issues, they involved adults choosing the media and how it was being delivered to the children. It appears that video games only show beneficial results when they are played under the structure of professionals. Similarly, educational television shows seem to be the only genre where there is not an association between viewing and later attention problems. In most every day circumstances, children do not have professionals choosing their video games, nor are they required to only watch educational television. It seems like it would be hard to generalize their findings to every day television viewing and video game usage because of this lack of professional guidance.

There are other conclusions that may be drawn from this literature review, as well. First, the associations between the number of hours that children watch television and their subsequent attention issues are very small (ages 1 and 3, 1.09 [1.03-1.15] and 1.09 [1.02-1.16], respectively) (Christakis et al., 2004) and (r = .03) (Stevens & Mulsow, 2006) unless the television shows being watched are classified as non-violent entertainment or containing violence. Then, the association is significant when children

viewed television shows classified as non-violent entertainment [OR = 1.73, 95% CI: 1.02-2.94, *p*= .04] or having violent content [OR = 2.20, 95% CI: 1.19-4.08, *p*= .01] before the age of 3. Second, there appears to be an association between video game playing and children with attention problems (Chan & Rabinowitz, 2006; Gentile et al., 2012; Swing et al., 2010). The final conclusion is there are definite benefits of certain electronic media when it is educational (McClanahan et al., 2012; Solomonidou et al., 2004).

Implications

The most prominent implication is that there is a need for further research in the field of video games and children with ADHD. While there seems to be a clear association between video game playing and children with ADHD, there needs to be more research determining if the genre of video games have effects on these children. Like Zimmerman and Christakis (2007) did for the association between types of television shows and children with ADHD, it is necessary for research to be done to find out the importance of the types of video games that children with ADHD are playing. Perhaps, this knowledge could inform parents better on what types of video games are appropriate for their children with ADHD.

In reference to Gentile et al. (2012), it makes sense to say that children playing video games for long periods of time have limited time to participate in other activities. It is hard to say, though, whether or not the other activities would have an impact on their attention, positive or negative. This claim cannot be made solely using Gentile et al. (2012)'s research.

Additionally, and maybe more importantly, more research needs to be completed in this field to answer the question that some of these researchers have asked: do students who already have ADHD simply play more video games and/or watch more television than their peers without ADHD? Many of these researchers are completing this research to eventually find out if watching television and/or playing video games leads to later attention problems. It is possible though, that the students already have ADHD and watching television and playing video games simply are activities that they prefer. Research needs to be done to answer: do children with ADHD play more video games than their peers without ADHD?

Research Purpose

Much research has been conducted in this area, but there are contradictory findings (Christakis et al., 2004; Stevens & Mulsow, 2006; Stevens et al., 2009). The contradictory findings indicate that more research is needed in this field. One purpose of this research is to determine who plays more video games: adolescents with ADHD or adolescents without ADHD. It is important to answer this question in order to determine if there are any possible future implications for the use of video games by children with ADHD.

Another purpose for this research is to gather data on how adolescents with and without ADHD spend their time out of school. The hours on a typical school day that these two populations spend using electronic media (video games or television) and participating in other activities (spending time with friends or family and spending time completing homework/studying) will be compared. It was important to include other the

time spent on activities, besides usage of electronic media, to see how the two populations compare in other areas of their lives. The results from this research may provide information on similarities and/or differences between the two populations. It may can be used to determine if electronic media needs to be incorporated in the lives of students more or less than it already is incorporated. Future research may be completed to discover the reasons behind these possible similarities and/or differences.

Research Question

Research Question - Is there a difference between adolescents with ADHD and adolescents without ADHD and the amount of time they spend

- playing video games;
- watching television;
- with their friends;
- with their family members;
- completing homework/studying?

CHAPTER THREE

Method

Data source. The National Center for Education Statistics within the Institute of Education Sciences has data from numerous longitudinal studies. The HSLS:09 was chosen for the present research due to the large sample size and data related to the research questions. The purpose of the HSLS:09 is to examine ninth grade students' paths from the beginning of high school through college and/or the workforce. Data from 21,444 9^{th} graders in 944 schools were included in the HSLS:09 during the fall of 2009. The students, along with their parents, teachers, counselors, and administrators, were asked to fill out questionnaires. Questions concerning academic ability, level of motivation, observed behaviors, medical diagnoses, parental information, demographics, and school history were included in the questionnaires.

There were 21,444 ninth grade students who participated in the study. This population consisted of 10,862 (50.7%) male students, 10,557 (49.2%) female students, and 25 (.1%) students who were missing gender information. These students were in ninth grade in public, charter, and private high schools from all 50 states and the District of Columbia. Out of the 21,444 students, 223 students (1.03%) were American Indian/Alaska Native, 2,144 students (10%) were Asian or Pacific Islander, 2,684 students (12.52%) were Black or African American, 3,516 (16.4%) were Hispanic, 12,630 (58.9%) were White, and 247 (1.15%) were "other race, more than one race, or

missing value."

Sampling procedures. The present research focused on responses given by parents and students on their respective questionnaires. These were the two groups (out of students, parents, administrators, teachers, and counselors) who answered questions related to the research question and hypotheses. Students of the parents who answered the question related to a medical diagnosis of ADHD for their child were included in this study. An application to the Institutional Review Board (IRB) was completed to ensure the ethical treatment of subjects. The IRB stated that permission and further steps were not needed since I did not have any interactions with the subjects.

Sample size, power, and precision. Of the 21,444 students included in the HSLS:09, 6,255 students were missing information on a diagnosis, or lack thereof, of ADHD. This left 15,189 ninth graders who had information on gender and on whether or not they have been diagnosed with ADHD. These 15,189 students made up the sample for the present study. Of the 15,189 students included in the sample, 7,600 (50.04%) students were male and 7,589 (49.96%) students were female. Additionally, 13,554 (89.24%) of students did not have ADHD, and 1,635 (10.76%) students did have ADHD.

Measures. The measures used to collect the data were questionnaires given to students and their parents, teachers, administrators, and counselors. For this current study, only the student and parent questionnaires were used. The students were asked to take a survey online, which included questions about demographics, career plans, and nonacademic activities. The parents took surveys online, or through a computer-assisted telephone interview (CATI), which included questions about their students': educational

success, learning styles, and medical diagnoses. The variables used from the HSLS:09 were: ADHD diagnosis, weekday hours spent playing video games, spent watching television, spent completing homework/studying, spent with family, or spent with friends.

Hours spent playing video games. This variable was derived from a question included in the student survey of the HSLS:09. The question asked, "during a typical weekday during the school year how many hours do you spend playing video games?" The students could answer this question with a 1 (less than 1 hour), 2 (1 to 2 hours), 3 (2 to 3 hours), 4 (3 to 4 hours), 5 (4 to 5 hours), or 6 (5 or more hours).

Hours spent watching television. This variable was based on a question included in the student survey of the HSLS:09. The question asked, "during a typical weekday during the school year how many hours do you spend watching television?" The students could answer this question with a 1 (less than 1 hour), 2 (1 to 2 hours), 3 (2 to 3 hours), 4 (3 to 4 hours), 5 (4 to 5 hours), or 6 (5 or more hours).

Hours spent completing homework/studying. This variable was based on three questions included in the student survey of the HSLS:09. The questions asked, "during a typical weekday during the school year how many hours do you spend working on math homework and studying for math class? During a typical weekday during the school year how many hours do you spend working on science homework and studying for science class? During a typical weekday during the school year how many hours do you spend working on homework and studying for the rest of your classes?" The students could answer these questions with a 1 (less than 1 hour), 2 (1 to 2 hours), 3 (2 to 3 hours), 4 (3 to 4 hours), 5 (4 to 5 hours), or 6 (5 or more hours) for each of these questions.

The HSLS:09 chose to focus on the number of hours spent working on homework, or studying, for math, science, and other because those researchers were interested in STEM (Science, Technology, Engineering, and Mathematics) related activities. In the current study, the subject for which students were completing homework or studying was deemed unnecessary. This research is more focused on the total amount of time spent on completing homework or studying, rather than for which subject the students are completing homework or studying. The one homework variable used in the current study was established through finding the mean of the three original homework variables from the HSLS:09 (science homework, math homework, and other homework). The reliability of the three original homework variables was calculated using Cronbach's alpha in SPSS (α =.79).

Hours spent with family. This variable was based on one question included in the student survey of the HSLS:09. The question asked, "during a typical weekday during the school year how many hours do you spend spending time with your family?" The students could answer this question with a 1 (less than 1 hour), 2 (1 to 2 hours), 3 (2 to 3 hours), 4 (3 to 4 hours), 5 (4 to 5 hours), or 6 (5 or more hours) for each of this question.

Hours spent with friends. This variable was based on one question included in the student survey of the HSLS:09. The question asked, "during a typical weekday during the school year how many hours do you spend spending time with your friends?" The students could answer this question with a 1 (less than 1 hour), 2 (1 to 2 hours), 3 (2

to 3 hours), 4 (3 to 4 hours), 5 (4 to 5 hours), or 6 (5 or more hours) for each of this question.

Data analysis procedures. The data from the students who included gender information on their questionnaire and whose parents included ADHD diagnoses information on their questionnaire were included in the analyses. In order to account for the large population, the sampling weights were included to create a weighted variable in the SPSS dataset. Means and standard deviations were calculated through SPSS for all the variables in the ADHD group and the without ADHD group. These were calculated to be able to compare the means of the two groups. A correlational analysis of all of the variables was also conducted through SPSS. This was performed so that relationships between the variables could be established. To compare the two sample means, *t*-tests were conducted in SPSS. Finally, the effect sizes were calculated using Cohen's *d*.

CHAPTER FOUR

Results

Normalized sampling weight. To create a weighted variable, sampling weights (W1STUDENT) provided by the dataset were used in the formula: (W1STUDENT/7259241.4)*15189. This formula was derived using the sample weights calculated by Ingels et al. (2011), the sum of W1STUDENT, and the sample size used for this analysis. Using these weights, N=5,897. A weighted variable was necessary to account for the size of the population.

Descriptive and correlational analyses. Descriptive and correlational analyses were conducted and included in this present research. It was important to conduct these analyses and include the results in order to fully understand all aspects of the data. The means, standard deviations, and correlations allowed for a clear picture of the variables compared with one another.

The means and standard deviations for each variable (hours spent watching television, hours spent playing video games, hours spent with family, hour spent with friends, and hours spent completing homework or studying) were calculated for students with ADHD and students without ADHD, See Table 1. Time spent playing video games showed the highest discrepancy between the means of the two groups. Students without ADHD played video games for a mean of 1.76 and students with ADHD played video

games for a mean of 2.30. Overall, the students with ADHD spent more time with electronic media (television and video games) and friends than their peers without ADHD. Conversely, the students with ADHD spent less time with family and homework/studying than their peers without ADHD.

Table 1

Means and standard deviations for students without ADHD and with ADHD

	Without ADHD[a]		*ADHD*[b]	
Variables	*M*	*SD*	*M*	*SD*
Television	2.42	1.50	2.63	1.57
Video Games	1.76	1.37	2.30	1.67
Family	3.56	1.79	3.32	1.78
Friends	3.15	1.71	3.31	1.80
Homework/ Studying	1.69	.76	1.62	.83

Note. ADHD = attention deficit hyperactivity disorder; M = mean; SD = standard deviation.
[a]Students whose parents answered "no" to the question asking about their child being diagnosed with ADHD.
[b]Students whose parents answered "yes" to the question asking about their child being diagnosed with ADHD.

In order to determine if there were any associations between the variables included in the research question (time spent with: video games, television, friends, family, and homework/studying), correlational analyses were performed (see, Table *2*). All of the correlations had positive relationships except for one. The number of hours students spent on homework/studying and the number of hours students spent playing video games did not yield a significant correlation. The relationships between homework/studying and friends (r =.05), homework/studying and family (r=.14), family and video games (r =.12), and friends and video games (r=.20) were positive and statistically significant (p<.01) but relatively low correlations. The relationships between family and friends (r=.34), family and television (r=.30), friends and television (r=.34),

and television and video games (r=.46) were moderate, positive and statistically significant (p <.01) correlations.

Table 2

Correlations among all variables

	Correlations				
Variables	1	2	3	4	5
1. Homework/ Studying	1.00				
2. Family	.14**	1.00			
3. Friends	.05**	.34**	1.00		
4. Television	.01	.30**	.34**	1.00	
5. Video Games	-.01	.12**	.20**	.46**	1.00

Note. **p<.01, two tailed

Comparing differences between groups: t-tests analyses. Independent *t*-tests were conducted to test for significant differences between the two groups for all variables. Under Levene's Test for Equality of Variances, p<.05 for hours spent hanging out with friends, hours spent watching television, and hours spent playing video games on a typical schoolday. When looking at the output, equal variances were not assumed. It was found that students with ADHD played more video games (M = 2.30, SD = 1.57) than the students without ADHD (M =1.76, SD=1.36), t(682)= -7.57, p<.01. It was also found that students with ADHD watched more television (M=2.63, SD =1.67) than

students without ADHD (M = 2.42, SD = 1.50), $t(729)$= -3.10, p<.01. Lastly, it was found that students with ADHD spent less time with family (M=3.32, SD=1.78) than students without ADHD (M=3.56, SD=1.79), $t(740)$= 3.11, p<.01). These results suggest that the students with ADHD play more video games and watch more television, but spend less time with family, than the students without ADHD.

The effect sizes for the *t*-tests were assessed using Cohen's *d* statistic (see Table III). Video games (d=-.58) had a medium effect size. Family (d=.23) and television (d=-.23) had small effect sizes. The effect sizes for homework (d=.13) and friends (d=-.16) were negligible (Ferguson, 2009). Thus, the differences between the two groups was the most significant when looking at the amount of time spent playing video games.

Table 3

t-tests and Cohen's d

Validity measures	Statistical *t* test (*df*)	Results Effect size *d*	*p*<.05
Homework	1.80 (732)	.13	.07
Family	3.11 (740)	.23	.00
Friends	-2.14 (728)	-.16	.03
Television	-3.10 (729)	-.23	.00
Video Games	-7.57 (682)	-.58	.00

CHAPTER FIVE

Discussion

As outlined before, the purpose of this research was to determine whether or not there were differences between ninth graders with ADHD and ninth graders without ADHD in the amounts of time they spent playing video games, watching television, completing homework/studying, with friends, and/or with family. The results indicate that there are both similarities and differences between the ninth graders with ADHD and the ninth graders without ADHD. This chapter discusses the comparison between the two samples and comparisons between the variables.

Ninth graders with ADHD. Students with ADHD represented 10.76% of the whole sample. This is slightly higher than the 9.5% of children and adolescents reported as having ADHD by their parents (CDC, 2010). This statistic is over double the 5% of all school-aged children having ADHD, as reported by the DSM-IV (APA, 2013).

The variable with the highest mean for this sample was hours spent with family. The mean for the variable of number of hours spent with friends was just .01 behind the mean for the variable of number of hours spent with family. The variable with the lowest mean was hours spent completing homework/studying.

Homework/studying takes up the least of their non-school time. This makes sense given the fact that one can complete multiple activities while in the company of family and/or friends. For example, students could count watching television, playing video

games, and completing homework/studying as also time with family and/or friends if these activities are done in the company of family and/or friends.

Ninth graders without ADHD. The variable with the highest mean for this sample was hours spent with family. The variable with the second highest mean was hours spent with friends. The variable with the lowest mean was hours spent completing homework/studying. Comparably to the students with ADHD, students could count watching television, playing video games, and completing homework/studying as also time with family and/or friends if these activities are done in the company of family and/or friends.

Comparing the two samples. Both students with ADHD and students without ADHD had the same variables with the highest mean and the lowest mean. Both samples also had the hours spent with friends as their second highest mean. However, the students with ADHD spent, on average, .16 more time with friends than the students without ADHD. The largest difference between means variables was the hours the students with ADHD played video games and the hours they spent completing homework/studying. The mean number of hours the students with ADHD played video games was .68 more than the number of hours they spent completing homework. The difference between the same two variable means for the students without ADHD was only .10. Statistically significant differences between the two samples were found between the mean number hours spent with family, spent watching television, and spent playing video games. The means for hours spent watching television for students with ADHD and students without ADHD indicate that the average student chose 2 (1-2 hours)

or 3 (2-3 hours) for this question. This indicates that the ninth graders in this study watch much less television than the national average of 4 hours and 29 minutes (Kaiser Family Foundation, 2009). The most statistically significant difference between the students with ADHD and without ADHD was found in the mean number of hours spent playing video games. This indicates that the average student with ADHD chose 2 (1-2 hours) or 3 (2-3 hours) on the video game question. This number is higher than the national average of 1 hour and 13 minutes spent playing video games (Kaiser Family Foundation, 2009).

Variables

Video games. According to the previously mentioned results, the ninth graders with ADHD played video games, on average, 1-3 hours a day. This coincides with the research done by Chan and Rabinowicz (2006). They found a significant increase in the amount of inattention and ADHD behaviors in adolescents that played video games for 1 hour or more a day. Similarly, Gentile et al. (2012) found that the amount of time children and adolescents spent playing video games was the main predictor of attention problems. Looking at the current research, there appears to be a relationship between the students with ADHD and a higher number of hours spent playing video games. This is especially true when you look at the mean number of hours spent playing video games across both samples. Since the difference between the two means is greater than the difference between any other like means, there seems to be a connection between the current research, Chan and Rabinowicz (2006) and Gentile et al. (2012).

Television. As stated above, the means for hours spent watching television for students with ADHD and students without ADHD indicate that the average student chose 2 (1-2 hours) or 3 (2-3 hours) for this question. This is lower than the number of hours supported by past research to show an association with later attention problems. The research completed by Johnson et al. (2007) and Landhuis et al. (2007) suggested an association between children or adolescents watching 3 or more hours of television a day and later attention problems. While the students with ADHD did have a higher mean for this variable, it's difficult to relate it to the Johnson et al. (2007) and Landhuis et al. (2007) studies since the mean is still less than their supported hour range.

The studies completed by Christakis et al. (2004), Stevens and Mulsow (2006), and Stevens et al. (2009) involve subjects between the ages of 1 and 10 years old. Because of the discrepancy of age ranges between these three studies and the current research, it is difficult to compare the findings.

Homework/studying. The relationship between homework/studying and friends and the relationship between homework/studying and family were statistically significant. Both relationships had very low correlations. The relationship between homework/studying and television and the relationship between homework/studying and video games were not statistically significant. Cummings and Vandewater (2007) found a similar relationship between homework/studying and video games, but only for the boys in their study. These researchers found a contrary relationship when looking at the girls in their study. They found that for every 1 hour girls played video games on the

weekdays, they completed 13 fewer minutes of homework (Cummings & Vandewater, 2007).

Family. The relationship between family and friends, the relationship between family and television, and the relationship between family and video games were all statistically significant. The relationship between family and friends and the relationship between family and television both had low correlations. The relationship between family and video games had a very low correlation. When looking back at the study completed by Cummings and Vandewater (2007), the only relationships they found between family and video games only occurred when the adolescents played video games on the weekends. In the research conducted by Rideout et al. (2006), 68% of parents watched television with their children most or all of the time. This seems to align with the correlation between family and television in this present research. This suggests that there could be some overlap between the two variables. More specifically, some students who watch television could be doing so with their families. Therefore, this time spent could be included under television and time with family.

Friends. The relationship between friends and television and the relationship between friends and video games were both statistically significant. These relationships had low correlations. Again, Cummings and Vandewater (2007) were only able to find a relationship between video games and friends when the adolescents played video games on the weekends. The correlations found in this present study appear to align with the findings of Roberts et al. (2005). In their research, the students who used electronic media for over 13 hours a day, also spent the most time with their friends. In Roberts et

al. (2005) and the current study, time with electronic media and time with friends both have positive correlations. This suggests that students who spend more time with electronic media also spend more time with their friends.

Implications

In this research, it was hypothesized that there would be statistically significant differences in the amounts of time that adolescents with and without ADHD watch television, play video games, spend with family, spend with friends, and/or complete homework/study. Indeed, there were statistically significant differences between the time students with and without ADHD spent watching television, playing video games, and with family. Since the mean number of hours spent watching television and playing video games was higher for the students with ADHD, and the mean number of hours spent with family was lower, one could infer that these students with ADHD are using electronic media instead of spending time with their family. Furthermore, the students without ADHD would have more time to spend with their families because they spend less time watching television and playing video games. There were no statistically significant differences in the amount of hours students with and without ADHD spent completing homework/studying or with friends.

The results of this study have many implications for parents, students, educators, administrators, and policy makers. All of the above groups would be interested in knowing that the students from both samples spent the least amount of time on homework/studying (compared to hours spent watching television, playing video games, with family, and with friends). As stated before, research shows students in high school

should receive 1-2 ½ hours of homework a night (Cooper, 1989; Lam, 1996). The means for the hours of homework variable for students with ADHD and students without ADHD indicate that the average student chose 1 (0-1 hours) or 2 (1-2 hours). If the students, on average, were completing the recommended 1-2 ½ hours of homework a night, a mean score of 2 or higher would need to be present. Neither students with ADHD, nor students without ADHD, had a mean score of 2 or higher for this variable.

Although students with ADHD did not have a mean score of 2 or higher for the homework/studying variable, they did have a mean score of higher than 2 for the video game variable and the television variable. This implies that ninth graders with ADHD, on average, are spending more time playing video games and/or watching television than they are completing their homework/studying. This is even more alarming if these students with ADHD are doing both activities (watching television and playing video games) each night for those time ranges.

Implications specifically for educators, administrators, and policy makers have to do with using video games to the advantages of teaching and learning. Using the understandings of the reward-seeking elements of dopamine (Koepp et al., 1998) and the "natural rewards" associated with dopamine (Blum et al., 2000), educators, administrator, and policy makers can use video games to engage students in interactive schoolwork and homework. Shaw et al. (2005) and Biolac et al. (2012) found that students with ADHD are much more engaged in learning than their peers without ADHD when they are working with visually appealing video games. Therefore, school professionals can use video games to help students with ADHD. Klopfer, Sheldon, Perry, and Chen (2012),

Petrov and Rogers (2011), and Simpson and Clem (2008) verified that video games can provide helpful feedback and reinforce correct learning as students are working through problems. This sort of feedback and positive reinforcement would be a great tool for homework since often students are working at home independently. Reinforcing video games could serve as an "at-home" teacher to guide a student's learning when he or she is away from school. Video games could be used as a helpful tool, rather than activities students do instead of homework.

Additionally, the way in which educators deliver instruction to students with ADHD can be guided using the findings of this study and others. These students may benefit from instruction that is engaging and in shorter intervals. This is evident in the previous research stating that students with ADHD performed much better when educational electronic media used short video clips, short narratives, attractive tasks, and/or fun games (Farrace-DiZinno, Douglas, Houghton, Lawrence, West, & Whiting, 2001; McClanahan, Williams, Kenney, and Tate, 2012; Solomonidou, Garagouniareou, & Zafiropoulou, 2004). These findings can be used in combination with the findings from this current study that shows students with ADHD spend more time playing video games than students without ADHD. Educators can use instructional strategies that mimic electronic media by making learning fun, engaging, and time-sensitive.

Limitations

Between the dataset and the analyses, there were a number of limitations. First, the scale provided to the students on their questionnaire had overlapping and confusing ranges. For example, several of the scales used the following ranges: 1 (less than 1 hour),

2 (1 to 2 hours), 3 (2 to 3 hours), 4 (3 to 4 hours), 5 (4 to 5 hours), or 6 (5 or more hours). Students who wanted to report watching 5 hours of television a school day could have chosen choice 5 or choice 6. Similarly, a student who watches 5 hours or 9 hours of television a day would need to chose the same range.

There is another limitation concerning the scale listed above. This scale is an ordinal scale in that the numbers 1-6 do not have an equal degree of difference between each number. In this present study, this ordinal scale is used as a continuous scale when the means and standard deviations were calculated. The results should be interpreted with caution, keeping in mind that they were found using a scale that is not continuous.

A final limitation of the dataset is the fact that it only included information based on the students' freshman year in high school. Many of the previously mentioned studies took a more longitudinal approach where their subjects were assessed during their childhood years and their adolescent years.

Need for Further Research

The results and implications of these analyses may lead to future research to find answers to why these students with ADHD watch television and play video games for more hours per day than the students without ADHD. Chan and Rabinowicz (2006) began to explore this topic when their findings suggested that children who played video games for 1 or more hours a day were, therefore, leaving less time in the day for other activities. These possible activities could possibly be the types to help increase their impulse control and decrease their inattention. Yet, it seems like there may be more to it than this answer alone.

With the current research showing that these ninth grade students with ADHD play video games and watch television for more time than their peers without ADHD, reasoning behind it lends itself to a plethora of questions. Besides the why question, it's also curious to know in what direction does this possible relationship flow. Do adolescents with ADHD play video games and watch television for more time because they are more attracted to these mediums than their peers without ADHD? Conversely, are adolescents with ADHD struggling with hyperactivity, impulsivity, and inattention because they play more video games and watch more television than their peers without ADHD?

Conclusion

The purpose of this research was to determine if there were differences between 9^{th} graders with ADHD and 9^{th} graders without ADHD in their out-of-school activities. In analyzing the results of this current story, it is clear that there are significant differences in the amount of hours spent watching television, playing video games, and spending time with friends. These differences open up arenas for future research in order to further examine differences between students with and without ADHD, to uncover why there are differences between these two groups, and how these out-of-school differences affect their school success.

APPENDIX

Question 1

Name**:** P1ADHD

Label: P1 D03G Doctor/school has told parent 9th grader has ADD or ADHD

Section**:** BY Parent Instrument

Type: Questionnaire

Description: Has a doctor, health car provider, teacher, or school official ever told you that [your 9th grader] has any of the following conditions? Attention Deficit Disorder or Attention Deficit Hyperactivity Disorder, that is ADD or ADHD.

Items: Yes; No

Question 2

Name**:** S1HRTV

Label: S1 E15H Hours spent watching television or movies on a typical school day

Section**:** BY Student Instrument

Type: Questionnaire

Description: During a typical weekday during the school year how many hours do you spend watching television or movies?

Items: Less than 1 hour; 1 to 2 hours; 2 to 3 hours; 4 to 5 hours; 5 or more hours

Question 3

Name**:** S1HRVIDEO

Label: S1 E15H Hours spent playing video games on a typical school day

Section**:** BY Student Instrument

Type: Questionnaire

Description: During a typical weekday during the school year how many hours do you spend playing video games?

Items: Less than 1 hour; 1 to 2 hours; 2 to 3 hours; 4 to 5 hours; 5 or more hours

Question 4

Name**:** S1HRFRIENDS

Label: S1 E15G Hours spent hanging out with friends on a typical school day

Section**:** BY Student Instrument

Type: Questionnaire

Description: During a typical weekday during the school year how many hours do you spend hanging out or socializing with your friends?

Items: Less than 1 hour; 1 to 2 hours; 2 to 3 hours; 4 to 5 hours; 5 or more hours

Question 5

Name**:** S1HRFAMILY

Label: S1 E15F Hours spent with family on a typical school day

Section**:** BY Student Instrument

Type: Questionnaire

Description: During a typical weekday during the school year how many hours do you spend spending time with your family?

Items: Less than 1 hour; 1 to 2 hours; 2 to 3 hours; 4 to 5 hours; 5 or more hours

Question 6

Name**:** S1HRMHOMEWK

Label: S1 E15A Hours spent on math homework/studying on a typical school day

Section**:** BY Student Instrument

Type: Questionnaire

Description: During a typical weekday during the school year how many hours do you spend working on math homework and studying for math class?

Items: Less than 1 hour; 1 to 2 hours; 2 to 3 hours; 4 to 5 hours; 5 or more hours

Question 7

Name**:** S1HRSHOMEWK

Label: S1 E15AB Hours spent on science homework/studying on a typical school day

Section**:** BY Student Instrument

Type: Questionnaire

Description: During a typical weekday during the school year how many hours do you spend working on science homework and studying for science class?

Items: Less than 1 hour; 1 to 2 hours; 2 to 3 hours; 4 to 5 hours; 5 or more hours

Question 8

Name**:** S1HROTHHOMWK

Label: S1 E15AC Hours spent on other homework/studying on a typical school day

Section**:** BY Student Instrument

Type: Questionnaire

Description: During a typical weekday during the school year how many hours do you spend working on homework and studying for the rest of your classes?

Items: Less than 1 hour; 1 to 2 hours; 2 to 3 hours; 4 to 5 hours; 5 or more hours

Appendix. U.S. department of education: Institute of education sciences: National center of education statistics. *High School Longitudinal Study of 2009*. Retrieved from http://nces.ed.gov/surveys/hsls09/

GEORGE MASON UNIVERSITY

Office of Research Integrity and Assurance

Research Hall, 4400 Univeristy Drive, MS 6D5, Fairfax, Virginia 22030
Phone: 703-993-5445; Fax: 703-993-9590

DATE:	August 1, 2014
TO:	Lori Bland
FROM:	George Mason University IRB
Project Title:	[608409-1] Relationships between electronic media and ADHD in Children and Adolescents
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF NOT HUMAN SUBJECT RESEARCH
DECISION DATE:	August 1, 2014

Thank you for your submission of New Project materials for this project. The Office of Research Integrity & Assurance (ORIA) has determined this project does not meet the definition of human subject research under the purview of the IRB according to federal regulations.

Please remember that if you modify this project to include human subjects research activities, you are required to submit revisions to the ORIA prior to initiation.

If you have any questions, please contact Bess Dieffenbach at 703-993-4121 or edieffen@gmu.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within George Mason University IRB's records.

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