

Digital Game Addiction Among Adolescents and Young Adults:

A Current Overview

ARTICLE IN PRESS



Aylin YALÇIN IRMAK¹, Semra ERDOĞAN²

SUMMARY

The games that adolescents and young people used to play in the playgrounds and on the streets have been replaced in recent years with electronic games played in front of the computer on the internet or in arcades. This changing culture has resulted in the concept of “digital game addiction”, a condition that stems from a steadily growing passion for digital games and their excessive and uncontrolled use among adolescents and young people. Game addiction has been described in the psychiatry literature as an impulse control disorder characterized by symptoms such as “the inability to control the time spent on game-playing”, “a loss of interest in other activities”, “continuing to play despite the adverse effects” and “feeling psychologically deprived when not able to play”. Although digital game addiction has not been widely accepted by psychiatric authorities as a psychiatric disorder, the increasing number psychiatry referrals due to problems accompanying this disorder, the efforts of families to seek support and solutions, the similarities with other types of addiction are all factors that suggest the existence of important of the examination of issue. Interest in the treatment of digital game addiction is growing among the psychology community. This article offers an overview of digital game-playing behavior in the context of the current literature for healthcare professionals.

Keywords: Video games, Computers, Addictive behaviors, Adolescent

INTRODUCTION

While computers and the Internet have made life easier in many respects, these new tools are widely used as gaming and entertainment devices. With the development of new technologies and the reduction in safe spaces for children to play in cities due to rapid urbanization, conventional games have been replaced by digital software. Although individuals from all age groups play these games, use by teens has been dramatically increasing (Gentile 2009, Rideout et al. 2010). Previous studies have reported that males between 10 and 19 years of age have a greater tendency to abuse digital games in comparison to females in the same age group (Chiu et al. 2004, Chou and Tsai 2007, Çakır et al. 2011, Gentile 2009, Greenberg et al. 2010, Griffiths et al. 2004a, Griffiths et al. 2004b, Griffiths and Meredith 2009, Grüsser et al. 2007, Horzum 2011, Ko et

al. 2005, Rideout et al. 2010, Quaiser-Pohl et al. 2006). The present generation of adolescents shows a tremendous interest in digital games; clearly we are living in an age where digital games are a central component of popular youth culture.

Limited engagement with digital gaming is considered normal and may have certain benefits, such as emotional discharge and relief (Green and Bavelier 2003, Prot et al. 2014). However, problematic or addictive gaming behavior occurs when individuals cannot control their desire to play digital games, and if gaming influences emotions, judgment, or social life (Griffiths and Davies 2005, Ögel 2012, Young 2009). Lemmens et al. (2009) define digital game addiction as, “excessive and compulsive use of computers or video games resulting in social and/or emotional problems; despite these problems, the gamer is unable to control this excessive use”.

Received: 29.12.2014 - **Accepted:** 04.09.2015

¹PhD, School of Health, Namik Kemal University, Tekirdağ, ²Prof., Public Health Nursing Department, Florence Nightingale Faculty of Nursing, Istanbul University, Istanbul, Turkey.

e-mail: ayalcin@nku.edu.tr

doi: 10.5080/u13407

Researchers use various terms for the concept of game addiction: “excessive computer game playing” (Charlton and Danforth 2007, Grüsser et al. 2007), “obsessive compulsive game playing” (Grüsser et al. 2007), “game addiction” (Charlton and Danforth 2007, Chiu et al. 2004, Chou and Ting 2003, Ko et al. 2005, Lemmens et al. 2009, Ng and Wiemer-Hastings 2005, Wan and Chiou 2006), “pathological game playing behaviors” (Gentile 2009), and “problematic game playing behaviors” (Desai et al. 2010). The term “game addiction” has not yet been widely adopted by clinicians. In Section III of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) published in May 2013 by the American Psychiatric Association (APA 2014), game addiction was denoted as Internet Gaming Disorder. The American Psychiatric Association recommends further clinical research and experience before including it in the DSM as a formal disorder.

Although digital gaming addiction is not defined in diagnostic manuals as a formal disorder, it has been discussed in the psychiatric literature for at least three decades (Soper and Miller 1983). In recent years the number of patients seeking treatments in psychiatry clinics for problems caused by digital gaming disorders has grown, resulting in increasing demand for support and solutions from family members; numerous recent publications have addressed the lack of research on this disorder (Griffiths and Meredith 2009, Ko 2014, Wood 2008, Young 2009). The current trend suggests that healthcare professionals, including psychiatrists, pediatricians, and those focusing on social problems, will be faced with increasing demand for treatment of digital gaming addiction.

In the present article we have chosen to adopt the term “digital gaming addiction”. Relevant literature was retrieved through PsycINFO, MEDLINE, Science Direct, PubMed, ULAKBIM (Turkish Academic Network and Information Center), Google Academics, and YÖK (Higher Education Council of Turkey) dissertation index search engines using the terms “computer games”, “video games”, “digital games”, and “addiction”, in both English and Turkish, and the publications found as a result of this search were reviewed. Findings regarding digital games, the epidemiology and neurobiology of digital gaming addiction, diagnostic criteria, measurement tools, contributing factors, their effects, and measures to prevent digital gaming addiction are presented with a particular emphasis on the professional healthcare setting.

DIGITAL GAMES

The digital gaming industry was started in 1971 with the release of Computer Space. Currently, with a 24.75 billion dollar annual revenue and over one billion users, the digital gaming industry comprises a substantial portion of the media world (Entertainment Software Association 2013). The increasing growth of the gaming industry, especially in the

1990s, brought about a wide variety of digital games that are meant to be consumed rapidly, causing a demand for newer games and newer versions of existing games. Currently there are many game titles in many genres that have been shaped by consumer demands. Although there is no consensus regarding the classification of digital games, Adams and Rollings (2006) have classified games in seven genres, namely strategy games, puzzle games, adventure games, action games, sports games, role-playing games, and simulations. In addition, there are online and offline digital games played on four types of medium: game consoles, computers, mobile devices, and arcades. These games are either single-player games or multi-player games. Digital game genres are presented in Table 1 with some samples for each genre.

Based on market research performed in 2013 by the Entertainment Software Association (ESA), 38% of games sold worldwide were strategy games and 31.9% were action games. In a study involving 341 participants with an age range of 18-51 years, Phan (2011) found that the participants mostly played strategy (47%), action (39%), and role-playing (39%) games. Gaming preferences vary according to gender. Females prefer non-violent, less competitive, slower, single-player, customizable, cartoon-style games with fantasy themes. Males, on the other hand, preferred exciting, life-like, violent and multiplayer online games requiring strategic planning (Homer et al. 2012, Quaiser-Pohl et al. 2006). The top-selling games are generally violent (Dill et al. 2005) and males and adolescents report a preference for violent games (Allahverdipour et al. 2010, Bunchman and Funk 1996, Gentile et al. 2004). Both male gender and the preference for violent games are key risk factors for the development of problematic gaming behaviors.

EPIDEMIOLOGY

The literature review revealed that the prevalence of digital game addiction varies between 0.6% and 15% (Desai et al. 2010, Gentile 2009, Grüsser et al. 2007, Lemmens et al. 2009, Poli and Agrimi 2012, Porter et al. 2010, Van Rooij et al. 2011). Problematic online gaming has been identified as an emerging public health problem in China, Korea, and Taiwan and national measures against this problem have been reported (Chiu et al. 2004, Dong et al. 2012, Hur 2006, Ko et al. 2005, Lin et al. 2011, Wan and Chiou 2007). A report published by the American Medical Association indicated that 90% of American adolescents play digital games and up to 15% may be digital gaming addicts (Tanner 2007). In a national study performed in Norway involving 2500 participants, the incidence of problematic digital gaming was reported to be 4.1% and addiction was 0.6% (Mentzoni et al. 2011). Digital gaming prevalence was reported to be 9% in Singapore (Gentile et al. 2011) and 8.7% (Choo et al. 2010), 5.6% (Dong et al. 2012) and 10.8% (Lam et al. 2010) in

Table 1. Digital Game Genres

Genre	Objective	Sample
Strategy	Strategic planning and exclusive tactics are required to win. Players plan a series of actions to eliminate the opposing forces managed by rival gamer(s).	Chess, Dune 2, Tycoon Series, Warcraft, StarCraft, Age of Empires, etc.
Puzzle	Players make plans to win on their own, i.e. there is no competitor. Players manage shapes, colors, or symbols in a certain pattern.	Angry Birds, Diamond Crush, Tetris, Frozen Bubble, Luxor, Sudoku Gridmaster, etc.
Adventure	Players try to find the route, collect objects, and solve puzzles in a mysterious world/story.	The Longest Journey, Indiana Jones, Myst and Riven, etc.
Action	Action games require several physical challenges, such as hand-eye coordination, good timing, high reaction time, and precision. These are games involving a lot of actions and speed. Players try to win the game against one or more players via bodily/physical actions along with mental efforts. Players are required to complete levels, collect various rewards, overcome obstacles, and survive the attacks.	Pac-Man, Call of Duty: Advanced Warfare, Grand Theft Auto , Far Cry, Dragon Age: Inquisition, Assassin's Creed, etc.
Sports	These are sports games requiring a lot of physical movements and techniques.	FIFA, NBA, Skating, Tennis, Championship Manager, etc.
Role-playing	Players assume the role of a character for a certain situation. The problems these characters face are solved using the contextual hints. Among the games in this genre, massively multiplayer online role-playing games (MMORPGs) allow a very large number of players interact with each other in an online medium where they assume various characters.	Dungeons & Dragons, EverQuest, Diablo, World of Warcraft, etc.
Simulation	These are never-ending games involving the creation of a virtual world, or practicing an action or the operation of a vehicle.	SimCity, The Sims, flight simulators, Trauma Center, etc.

PS: The games listed as samples may also have features of other genres.

Resource: (http://en.wikipedia.org/wiki/Video_game_genres#Strategy (Accessed: December 19, 2014), Ögel 2012, Adams and Rollings 2006)

China, 8.0% in Australia (Porter et al. 2010), 11.9% in Germany (Grüsser et al. 2007), and 15.1% in Taiwan (Lin et al. 2011). Few published studies have examined digital gaming addiction in Turkey (Çakır et al. 2011, Demirtaş Mardan and Ferligül Çakılcı 2014, Güllü et al. 2012, Horzum 2011, Pala and Erdem 2011), and no sufficient epidemiological data were available to identify the severity of the problem. Although no national prevalence indicator is available, Irmak (2014) performed a doctoral dissertation involving 865 adolescents that reported a noteworthy addiction rate of 28.8%.

Digital gaming addiction prevalence may vary from culture to culture, and there may be significant prevalence differences within a society (Hur 2006, Jang et al. 2008). In this regard, some studies have reported very low prevalence of digital gaming addiction (<1%) (Mentzoni et al. 2011) and others have reported very high rates of gaming addiction (>35%) (Leung 2004). This difference in the reported prevalence rates stems from the differences in diagnostic criteria, measurement tools, and research methods employed as well as the specific features of the study groups.

NEUROBIOLOGY

Neurobiological evidence is important in conceptualizing and comprehending psychological disorders. Such evidence increases the validity and reliability of clinical diagnostics, and thus helps with the provision of the most appropriate treatment (Kupfer and Regier 2011, Kuss 2013). In the last decade neuroimaging techniques, which allow for the analysis of

neurobiological changes and neurochemical correlations have been utilized in investigations of digital gaming addiction (Kuss and Griffiths 2012a, Kuss 2013). Kuss and Griffiths systematically reviewed 18 studies utilizing neuroimaging techniques to evaluate internet and digital gaming addiction. They reported similarities with regard to the neural circuits as well as the molecular and behavioral characteristics of various addiction types, including gaming and substance addiction (Kuss and Griffiths 2012a).

Functional magnetic resonance imaging (fMRI) has been used to examine activated parts of the digital gaming addict's brain using game-related stimulants. Specific regions of the brain are activated in individuals with gaming addiction relative to control subjects, including the orbitofrontal cortex (Han et al. 2010b, Hoeft et al. 2008, Ko 2009, Ko 2014), nucleus accumbens (Hoeft et al. 2008, Ko 2009), anterior cingulate (Han et al. 2010b, Ko 2009), medial frontal cortex (Ko 2009), dorsolateral prefrontal cortex (Han et al. 2010a, Hoeft et al. 2008, Ko 2009), right caudate nucleus (Ko 2009), bilateral caudate nucleus (Ko 2014), left occipital lobe (Han et al. 2010a), amygdala (Hoeft et al. 2008), insular cortex (Hoeft et al. 2008), and the left parahippocampal gyrus (Han et al. 2010a). Han et al. (2012) reported a gray matter increase in the left thalamus, and a gray matter decrease in the inferior temporal gyrus, the right occipital gyrus, and the left inferior occipital gyrus among gaming addicts. Furthermore, Hoeft et al. (2008) reported greater activation (right nucleus accumbens, bilateral orbitofrontal cortex, right amygdala) and functional connection (right nucleus accumbens, right amygdala) in the mesocorticolimbic reward circuitry of male gamers

compared to the female gamers. Based on these findings, Kuss and Griffiths (2012a) claim that the neural processes and increased activities in these parts of the brain following exposure to game-related stimulants are similar to those of substance addicts as well as those of the other behavioral addicts.

Despite the scarcity of neurochemical evidence, Han et al. (2007) studied 79 adult game addicts and found that among gaming addicts polymorphisms of the dopaminergic system such as the Taq1A1 allele of the dopamine D2 receptor and the catechol-O-methyltransferase (COMT) gene, were more common among gaming addicts, similar to substance addicts. Moreover, Koeppe et al. (1998) studied 8 male participants via positron emission tomography (PET) and observed that raclopride binding to the striatum dopamine receptors decreased during play time relative to resting. These findings indicate that digital gaming addiction is related to a reward deficiency, and mesocorticolimbic pathway and dopamine play an important role in rewarding and positively reinforcing the role of digital games. In summary, neurobiological studies present evidence for associating digital gaming addiction with deviations from normal values with regard to physiological, biochemical, and neurological assessments.

DIAGNOSTIC CRITERIA AND MEASUREMENT TOOLS

Several measurement tools have been used in the assessment of gaming addiction.

- Measurement tools adapted from DSM 2005-2013 “pathological gambling” diagnostic criteria (e.g., Charlton and Danforth 2007, Chou and Ting 2003, Lemmens 2009).
- Measurement tools adapted from ICD-10 “pathological gambling” diagnostic criteria (e.g., Grüsser et al. 2007, Thalemann et al. 2007).
- Measurement tools developed by researchers (e.g., Chiu et al. 2004, Horzum et al. 2008, Kaya 2013, Ng and Wiemer-Hastings 2005, Wan and Chiou 2006).

For the evaluation of digital gaming addiction, the “pathological gambling” criteria included in DSM (APA, 2013) have been widely adopted. Griffiths, a pioneering researcher in this field, defined digital gaming addiction according to 7 items, which were adapted from the pathological gambling diagnostic criteria (Griffiths and Davies 2005).

1. *Salience:* Gaming becomes an important part of the gamer’s life, and plays a dominant role in their mind (intense mental preoccupation), feelings (strong urge), and behaviors (abuse). The gamer’s mind is frequently occupied with games instead of other things, and they frequently imagine themselves playing games. They ignore school- or work-related responsibilities, tasks, projects,

assignments or social activities, miss related deadlines, and focus exclusively on games, which become the center-point of their lives. As the addiction process advances, gamers are less interested in other hobbies or social relationships/activities, and prefer to play digital games.

2. *Tolerance:* Gamers gradually extend the time they spend on games to prolong the feeling they get while playing. There is a positive correlation between the time spent on games and digital gaming addiction (Gentile 2009, Rideout et al. 2010). Ögel (2012) and Van Rooij et al. (2011) maintain that the time spent on games may expedite the addiction process and upholds the development of addiction symptoms; however, it should not be considered as the sole diagnostic criterion. For example, although two individuals may spend the same amount of time playing games, the symptoms of addiction may differ for each player (Ögel 2012). In other words, when a player spends an inordinate amount of time playing games, such gamers cannot be assumed to be game addicts unless this diagnosis is supported by other diagnostics criteria.

3. *Withdrawal:* Defined as the unpleasant feelings or physical effects that appear when an activity is suddenly interrupted or is not maintained. Addicted gamers who do not have access to games have the strong desire to play, and may be extremely angry, anxious, withdrawn, and depressive. To avoid the psychological withdrawal feeling when they cannot access to the games, they may become angry and even have violent feelings against anyone obstructing their access to these games. Feelings of alienation may take root.

4. *Mood modification:* This concept refers to the subjective experiences and feelings of the gamers during gaming. For instance, they may become excited or may calm down while playing games. Gamers utilize gaming as a way of avoiding problems or negative feelings (e.g., despair, guilt, misery, depression, and anxiety), and they try to forget their problems by engaging with the joy of gaming. As the overwhelming problems they face remain or intensify, they increase the frequency and duration of gaming.

5. *Relapse:* Gamers make unsuccessful attempts to control their gaming behavior and experience difficulty in decreasing the time they spend on gaming. In response to this feeling of withdrawal, the tendency to play games may dramatically increase and the individual may relapse to the highest level of addiction. When parents impose limitations on a child’s gaming time, the child may become aggressive and angry.

6. *Conflict:* Gamers are at conflict with themselves or with the people around them (including people from work, school, and social circles). Conflicts may involve lying,

cheating, or verbal/physical aggression. For instance, gamers may be negligent with regards to self-care such as bathing, eating, and sleeping in order to continue playing games. They tell lies to their family and friends regarding their computer use.

7. **Problems:** The desire to continue playing games causes gamers to lose their jobs, fail at school, lose scholarships, break up with boyfriends/girlfriends, divorce, and neglect their personal hygiene. Despite the consequences of gaming, the gamer maintains their extensive game playing activities (Griffiths and Davies 2005).

Three digital game addiction scales in Turkey were accessed. First, we assessed the Online Gaming Scale developed by Kaya (2013) and administered to 327 middle school students as part of the author's MA dissertation. Second, the Computer Game Addiction Scale for Children was developed by Horzum et al. (2008) and administered to 460 primary school students. Third, the Digital Game Addiction Scale was originally developed by Lemmens et al. (2009), and adapted to Turkish by Irmak and Erdoğan (2015), who also established its validity and reliability.

FACTORS SUPPORTING GAME ADDICTION

Some features of digital games and the feelings they offer to gamers are considered to be factors supporting the development of gaming addiction. These features and feelings may cause the players to spend a prolonged period of time playing the game, leading to addiction. Yee (2006) grouped the motivations of the gamers into the categories "achievement", "social" and "immersion".

Achievement Factors

- **Leveling up/Advancing:** The desire to obtain power and rewards, and fast advancement, winning virtual fortunes or status.
- **Mechanics:** To improve the performance of the main character, the urge to find out the fundamental rules of the game, and to unravel the whole system.
- **Competition:** The desire to compete with other players.

Social Factors

- **Socializing:** The opportunity to socialize and collaborate with other gamers.
- **Relationship:** An opportunity for friends from different locations to get together at the same time to play online games, and an opportunity for them to have long-term meaningful relationships.
- **Team work:** Satisfaction of being a part of a team.

Immersion

- **Exploration:** Carrying out tasks based on discovery and exploration, and the mystery of the game.
- **Role-playing:** The opportunity for the player to create a character that suits his/her personality, to establish improvised interaction with other players, and to play a role that s/he desires to have in real life.
- **Customization and Control:** The ability to customize the player character and gaming environment.
- **Escaping from Reality:** An opportunity to avoid daily-life problems, stress, fear, and negative feelings.

Kuss and Griffiths (2012b) and Ögel (2012) also reported that games are low-cost and easy-to-access, and can be played at home, work, or while riding a bus. Many games are freely available.

POSITIVE AND NEGATIVE EFFECTS OF DIGITAL GAMES

Negative Effects

The dramatic increase in the number of games and gamers has attracted attention to the effects of digital games. The ever-growing body of literature regarding digital games has focused on their short- and long-term effects.

The most thoroughly researched aspect of this field is the relationship between gaming and psychosocial and behavioral problems. Playing digital games involving violence has been associated with several psychosocial problems, such as loneliness (Wack and Tantleff-Dunn 2009), low life satisfaction level (Mentzoni et al. 2011), depression (Mentzoni et al. 2011), aggressive behaviors (Anderson and Carnagey 2009, Anderson and Carnagey 2005, Anderson et al. 2008, Anderson et al. 2004, Bartholow et al. 2005, Bilgi 2005, Bluemke et al. 2010, Demirtaş Mardan and Ferligül Çakılcı 2014, Gentile et al. 2004, Möller and Krahé 2009, Olson et al. 2009, Polman et al. 2008, Wang et al. 2009), anxiety (Gentile et al. 2004, Mentzoni et al. 2011), violent tendencies (Fischer et al. 2010, Williams et al. 2011), decreased positive social behaviors (Greitemeyer and Müge 2014), attention deficits (Chan and Rabinowitz 2006, Gentile 2009, Gentile et al. 2012), increased hostile behaviors (Gentile et al. 2004, Hasan et al. 2013), and insensitivity to violence (Anderson and Bushman 2009, Bartholow et al. 2005, Engelhardt et al. 2011, Hummer et al. 2010, Montag et al. 2012, Wang et al. 2009). Starcevic et al. (2011) reported that, problematic digital gamers scored higher in all psychopathology sub-scales of the Symptom Check List 90 (SCL-90), namely somatization, obsession, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism compared to normal gamers.

Positive Effects

Two previous studies, one longitudinal study and one meta-analysis, have presented striking results regarding the relationship of violent digital games with psychosocial and behavioral problems. Gentile et al. (2011) investigated the association of digital game addiction with depression and school success in 3034 children and teens in Singapore for 2 years. The participants in this study were divided into 4 groups, namely (I) non-addict gamers, (II) normal gamers becoming addicts, (III) addicted gamers becoming non-addicts, and (IV) gamers who remained addicted throughout the study. Among normal gamers who became addicted, depression, anxiety, and social phobia developed and school performance decreased. In addicted gamers who became non-addicts, depression, anxiety, school performance, and social phobia improved.

Anderson et al. (2010) performed a meta-analysis involving 130,000 participants and 136 research articles comprising the most comprehensive study on the effects of violent digital games on aggression and related parameters. The study included data from both published and unpublished studies conducted in both eastern and western cultures. This meta-analysis showed that violent digital games increased violent behaviors and thoughts as well as physiological impulses towards violence. Furthermore, the authors reported that individuals who play violent games over a significant period of time decreases in sensitivity to violence, empathic feelings, and prosocial behavior. These associations extended to gamers of both genders and across cultures.

On the other hand, another meta-analysis on the same topic by Ferguson (2007) and involving 3602 participants and 25 studies contradicts the results of Anderson et al. (2010) by reporting that the influence of digital games on aggressive behavior were insignificant. A 3-year longitudinal study performed by the same researchers (Ferguson et al. 2012) also found no relationship between violent digital games and aggression. Taken together these findings indicate that there may be merit in the hypothesis that uncontrolled use of violent games may pose a risk for mental health; however, use of such games should not be considered as the single factor in the evaluation of psychosocial problems. Aside from the mental problems cited above, previous studies have also reported low academic achievement (Anand 2007, Chan and Rabinowitz 2006, Chiu et al. 2004, Gentile 2009, Gentile et al. 2004, Sharif and Sargent 2006,) insufficient sleep/irregular sleeping patterns (Foti et al. 2011, King et al. 2013), insufficient physical activity/sedentary life style (Ballard et al. 2009, Fullerton et al. 2014), diets-related obesity (Ballard et al. 2009, Fullerton et al. 2014), musculo-skeletal problems, and insufficient self-care (Manteghi 2002) among individuals who spend an inordinate amount of time playing digital games.

Although most studies on digital games have focused on their negative effects, positive effects have also been reported, such as reduction in fatigue and stress. Video games are recreational and provide an opportunity for people to relax and have fun by escaping from complicated urban life and intense work pressure and stressful environments. Digital games may help people deal with problems, increase self-confidence, and improve visual attention skills (Green and Bavelier 2003, Griffiths 2005). In particular, educational games have been associated with improved school achievement (Green and Bavelier 2003, Prot et al. 2014).

Drummond and Sauer (2014) reanalyzed the 2009 PISA (Programme for International Student Assessment) data involving over 192,000 students from 22 countries, and examined the effects of digital games on achievement in science, math, and reading in teenagers. They found that time spent on digital games had little effect on the teens' success in school. This supports the report by Wack and Tantleff-Dunn (2009) that there is no meaningful correlation between the frequency of gaming and GPA in males. Previous studies also claimed that educational games expedite learning, increase success in targeted subjects, and improve student attention and interest (Gentile and Gentile 2008). Taking advantage of these features of digital games, Wang and Chen (2010) used educational digital games to teach math, reading, and biology, and to improve students learning motivation.

Furthermore, games involving prosocial elements were shown to decrease aggressive thinking, feelings, and behaviors, and increase collaboration, sharing, empathy, and prosocial behaviors (Gentile 2009, Greitemeyer and Osswald 2010, Narvaez et al. 2008, Sestir and Bartholow 2010). Studies carried out by Biddiss and Irwin (2010) and Graf et al. (2009) have reported that exercise gaming, which is performed using gaming consoles with body tracking sensors, increased the user's motivation to exercise and encouraged them to spend more time exercising. Use of such technology is increasing in Turkey.

The above-mentioned studies regarding the effects of digital games demonstrate that educational, informative, and constructive digital games support the development of children and teens when they are played in a controlled way and within normal time limits.

RECOMMENDATIONS FOR THE PREVENTION OF DIGITAL GAME ADDICTION

Due to the massive amount of time adolescents and adults spend on digital games and the widespread preference for violent games, preventive measures must be taken early and, if needed, interventions should be conducted prior to the development of digital gaming addiction. To this end, the family

environment is critical for encouraging healthy socialization and positive/conscious behaviors. Studies have shown that disorders such as internet and digital gaming addiction are more common in families experiencing domestic disputes (Feng et al. 2003, Ögel 2012), while healthy relationships between parents and children can prevent the development of these problems (Chiu et al. 2004, Jeong and Kim 2011). Adolescents may use the internet and digital games to rebel against domineering parents as well as society as a whole. Therefore, the basic principles in the development of conscious and controlled internet and digital gaming behavior lie in the development of trust within the family, democracy, support, strong communication, and positive parent-children relationships.

Regarding the prevention and treatment of digital gaming addiction, Griffiths (2003) recommended the followings for families:

- Set forth basic principles regarding when, where, how long, and what type of game your child can play and be rigid in applying these rules.
- Be informed about the content of the digital games your child chooses to play and direct him/her to select educational games appropriate for his/her age instead of violent games. Even when the content of the game is appropriate, set some ground rules and limitations. Instead of telling them not to play a particular game, accompany them when they play appropriate games.
- Talk to children about the content of a game and make sure that they can distinguish between real life and the virtual experience.
- Encourage your child to play digital games somewhere visible to everyone and not in his or her bedroom.
- Encourage your child to play games in which players cooperate with and talk to each other.
- Use games as a reward for completed homework or for other important tasks that have been successfully completed.
- Ensure that children obey the rules recommended by experts, such as sitting at least 2 m away from the display, playing in a well-lit environment, reducing the brightness level of the screen, and ending play when fatigued.
- Facilitate other social activities in addition to digital games.
- If your child fails to obey the rules, forbid game play for a period of time and resume only for short periods.

Furthermore, answers to questions such as “What is the normal limit for playing games?”, “Is my child a gaming addict?”, or “How can I distinguish between normal and problematic game playing?” can be found using the Turkish-Digital

Gaming Addiction Scale, a short (7-item) questionnaire. If an individual answers more than half of the items on the scale as “sometimes”, “frequently”, or “always”, then there is a risk that the individual may be adversely affected by game playing, and may be at risk of developing digital game addiction (Irmak and Erdoğan 2015). In that case, psychiatric help should be sought.

In addition to prevention of digital gaming addiction at the family level, legislative action is also needed. Laws enacted in 2007 in Turkey entitled “Regulating Broadcasting in the Internet and Fighting against Crimes Committed through Internet Broadcasting” created regulations regarding digital games. However, no measures have been taken to limit access to violent digital games, and no action has been taken to develop, administer, or monitor a rating system for games that would indicate the appropriate audience (Güneş 2012, Gürcan et al. 2008).

Mandatory courses in Turkey (MEB 2014) such as “Media Literacy” (Grades 7 and 8/optional) and “Information Technologies and Software” (Grades 5 and 6, compulsory; Grades 7 and 8, optional) could be used to instruct school children regarding the harmful effects of games with inappropriate content and to improve the positive effects of game.

Healthcare professionals, guidance counselors, and parents should be provided with instructional material regarding digital gaming addiction and accompanying problems, symptom check lists, and methods for the prevention and treatment of digital game addiction.

Psychiatric treatment should be provided to adolescents who struggle with digital gaming addiction. Liu and Peng (2009) described the underlying feelings (feeling lost, low self-esteem, loneliness, and stress) and cognitive distortions (nobody likes me in real life, the online gaming world is the only place I am respected, I am nobody offline and I become myself and esteemed online) behind excessive and uncontrolled gaming behaviors. They maintained that players with this kind of mindset may become aggressive or present withdrawal symptoms if games are withdrawn suddenly. Liu and Peng recommend approaching these individuals with care to identify and reverse these feelings and distortions in order to address these problematic behaviors at their source. In addition to pharmacological treatment, Cognitive Behavioral Therapy and Motivational Interviewing is effective for identifying such thoughts, coping with them, and preventing relapse (Davis 2001, Griffiths 2014, Griffiths and Meredith 2009, Liu and Peng 2009, Young 2009).

Digital games are among the popular and widely used entertainment tools among adolescents and adults. Numerous studies have demonstrated several positive effects of digital games as well as the concept of “digital gaming addiction”. Digital gaming addiction is better defined by the negative

outcomes rather than the time spent on games. Uncontrolled use of violent digital games threatens mental health, however, such activities should not be considered the only cause of mental problems. Educational and developmental digital games may contribute to mental development in adolescents when used in a controlled way and within certain time limits. In Turkey, the high proportion of young people within the general population, popular use of digital technologies, and insufficient monitoring of game use makes digital game addiction a significant public health concern. However, further studies investigating digital gaming addiction in adolescents and young people in Turkey are warranted.

REFERENCES

- Adams E, Rollings A (2014) *Fundamentals of Game Design*. 3.Baskı, Prentice Hall, s.67-81.
- Allahverdipour H, Bazargan M, Farhadinasab A et al (2010) Correlates of video games playing among adolescents in an Islamic country. *BMC Public Health*, 10:1-7.
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*, 5. Baskı, 2013. Retrieved December 19 2014, From <http://www.dsm5.org/Documents/Internet%20Gaming%20Disorder%20Fact%20Sheet.pdf>
- Anand V (2007) A study of time management: The correlation between video game usage and academic performance markers. *Cyberpsychol Behav* 10:552-9.
- Anderson CA, Bushman BJ (2009) Desensitizing effects of violent media on helping others. *Psychol Sci* 20:273-7.
- Anderson CA, Carnagey N (2005) The effects of reward and punishment in violent video games on aggressive affect, cognition and behavior. *Psychol Sci* 16:882-9.
- Anderson CA, Carnagey NL (2009) Causal effects of violent sports video games on aggression: Is it competitiveness or violent content ? *J Exp Soc Psychol* 45:731-9.
- Anderson CA, Funk JB, Griffiths MD (2004) Contemporary issues in adolescent video game playing: Brief overview and introduction to the special issue. *J Adolesc* 27:1-3.
- Anderson CA, Sakamoto A, Gentile DA et al (2008) Longitudinal effects of violent video games on aggression in Japan and the United States. *Pediatrics* 122: e1067-72.
- Anderson CA, Shibuya A, Ihori N et al (2010) Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: A meta-analytic review. *Psychol Bull* 136:151-73.
- Ballard M, Gray M, Reilly J et al (2009) Eating behaviors correlates of video game screen time among males: Body mass, physical activity, and other media use. *Eat Behav* 10:161-7.
- Bartholow BD, Sestir MA, Davis EB (2005) Correlates and consequences of exposure to video game violence: Hostile personality, empathy, and aggressive behavior. *Pers Soc Psychol Bull* 31:1573-86.
- Biddiss E, Irwin J (2010) Active video games to promote physical activity in children and youth. *Arch Pediatr Adolesc Med* 164:664-72.
- Bilgi A (2005) *Bilgisayar oyunu oynayan ve oynamayan ilköğretim öğrencilerinin saldırganlık, depresyon ve yalnızlık düzeylerinin incelenmesi*. Yayınlanmamış yüksek lisans tezi. Marmara Üniversitesi.
- Bluemke M, Friedrich M, Zumbach J (2010) The influence of violent and nonviolent computer games on implicit measures of aggressiveness. *Aggress Behav* 36:1-13.
- Buchman DD, Funk JB (1996) Video and computer games in the '90s: Children's time commitment and game preference. *Child Today* 24:12-6.
- Chan PA, Rabinowitz T (2006) A cross-sectional analysis of video games and attention deficit hyperactivity disorder symptoms in adolescents. *Ann Gen Psychiatry* 5:16-6.
- Charlton JP, Danforth IDW (2007) Distinguishing addiction and high engagement in the context of online game playing. *Comput Human Behav* 23:1531-48.
- Chiu S, Lee J, Huang D (2004) Video game addiction in children and teenagers in Taiwan. *Cyberpsychol Behav* 7:571-81.
- Choo H, Gentile DA, Sim T et al (2010) Pathological video-gaming among Singaporean youth. *Ann Acad Med Singapore* 39:822-9.
- Chou C, Tsai MJ (2007) Gender differences in Taiwan high school students' computer game playing. *Comput Human Behav* 23:812-24.
- Chou T, Ting C (2003) The role of flow in cyber-game addiction. *Cyberpsychol Behav* 6:663-75.
- Çakır Ö, Ayas T, Horzum MB (2011) Üniversite öğrencilerinin internet ve oyun bağımlılıklarının çeşitli değişkenlere göre incelenmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi* 44:95-117.
- Davis RA (2001) A cognitive-behavioral model of pathological Internet use. *Computers in Human Behavior* 17:187-95.
- Demirtaş Madran HA, Ferligül Çakılcı E (2014) Çok oyunculu çevrimiçi video oyunu oynayan bireylerde video oyunu bağımlılığı ve saldırganlık. *Anadolu Psikiyatri Derg* 15:99-107.
- Desai RA, Krishnan-Sarin S, Cavallo D et al (2010) Video-gaming among high school students: Health correlates, gender differences, and problematic gaming. *Pediatrics* 125:173-83.
- Dill KE, Gentile DA, Richter WA et al (2005) Violence, Sex, Age And Race in Popular Video Games: A Content Analysis. *Featuring Females: Feminist Analyses of Media*. E. Cole, J. Henderson-Daniel (Ed), Washington, DC: American Psychological Association s.115-30.
- Dong G, Wang J, Yang et al (2012) Risk personality traits of internet addiction: A longitudinal study of Internet-addicted Chinese university students. *Asia Pac Psychiatry* 5:316-21.
- Drummond A, Sauer JD (2014) Video-games do not negatively impact adolescent academic performance in science, mathematics or reading. *Plos One* 9:e87943
- Dünya Sağlık Örgütü (1992) *ICD-10 Ruhsal ve Davranışsal Bozukluklar Sınıflandırılması*. (Çev. ed.: MO Öztürk, B. Uluğ, Çev.: F. Çuhadaroğlu, İ. Kaplan, G. Özgen, MO Öztürk, M Rezaki, B Uluğ). Türkiye Sinir ve Ruh Sağlığı Derneği Yayını, Ankara, 1993.
- Engelhardt CR, Bartholow BD, Kerr GT et al (2011) This is your brain on violent video games: Neural desensitization to violence predicts increased aggression following video game exposure. *J Exp Soc Psychol* 47:1033- 6.
- Entertainment Software Association (2013) *Essential Facts About Computer and Video Industry 2012*. Washington D.C, USA: Entertainment Software Association.
- Feng Y, Yan X, Guo X et al (2003) Behavior problem and family environment of children with video game dependence. *Chinese Mental Health Journal* 17:367-8.
- Ferguson CJ (2007) The good, the bad and the ugly: A meta-analytic review of positive and negative effects of violent video games. *Psychiatr Q* 78:309- 16.
- Ferguson CJ, San Miguel C, Garza A et al (2012) A longitudinal test of video game violence influences on dating and aggression: A 3-year longitudinal study of adolescents. *J Psychiatr Res* 46:141-6.
- Fischer P, Kastenmüller A, Greitemeyer T (2010) Media violence and the self: The impact of personalized gaming characters in aggressive video games on aggressive behavior. *J Exp Soc Psychol* 46:192-5.
- Foti KE, Eaton DK, Lowry R et al (2011) Sufficient sleep, physical activity, and sedentary behaviors. *Am J Prev Med* 41:596-602.
- Fullerton S, Taylor AW, Grande ED et al (2014) Measuring physical inactivity: Do current measures provide an accurate view of "sedentary" video game time ?. *J Obes* 2014:287013.
- Gentile DA (2009) Pathological video game use among youth 8 to 18: A national study. *Psychol Sci* 20:594-602.
- Gentile DA, Choo H, Liau AK et al (2011) Pathological video game use among youths: A two-year longitudinal study. *Pediatrics* 127:e319-29.
- Gentile DA, Gentile JR (2008) Video games as exemplary teachers: A conceptual analysis. *J Youth Adolesc* 37:127-41.

- Gentile DA, Lynch PJ, Linder JR et al (2004) The effects of violent video game habits on adolescent hostility, aggressive behaviors and school performance. *J Adolesc* 27:5-22.
- Gentile DA, Swing EL, Lim CG et al (2012) Video game playing, attention problems, and impulsiveness: Evidence of bidirectional causality. *Psychol Pop Media Cult* 1: 62-70.
- Graf DL, Pratt LV, Hester CN et al (2009) Playing active video games increases energy expenditure in children. *Pediatrics* 124:534-40.
- Green CS, Bavelier D (2003) Action video game modifies visual selective attention. *Nature* 423:534-7.
- Greenberg BS, Sherry J, Lachlan K et al (2010) Orientations to video games among gender and age groups. *Simul Gaming* 41:238-59.
- Greitemeyer T, Müge DO (2014) Video games do affect social outcomes: A meta-analytic review of the effects of violent and prosocial video game play. *Pers Soc Psychol Bull* 40:578-89.
- Greitemeyer T, Osswald S (2010) Effects of prosocial video games on prosocial behavior. *J Pers Soc Psychol* 98:211-21.
- Griffiths MD (2014) An Overview Of Online Gaming Addiction. *Multiplayer: The Social Aspects Of Digital Gaming* (Routledge Studies in European Communication Research and Education). T. Quandt, S. Kröger (Eds), New York. Routledge, s:195-200.
- Griffiths MD (2003) Video games: Advice for teachers and parents. *Education and Health* 21:48-9.
- Griffiths MD (2005) The Therapeutic Value of Videogames. *Handbook of Computer Game Studies*. J. Goldstein, J. Raessens (Eds), Boston. MIT Pres s.161-71.
- Griffiths MD, Davies MNO, Chappell D (2004a) Demographic factors and playing variables in online computer gaming. *Cyberpsychol Behav* 7:479-87.
- Griffiths MD, Davies MNO, Chappell D (2004b) Online computer gaming: A comparison of adolescent and adult gamers. *J Adolesc* 27:87-96.
- Griffiths MD, Davies, MNO (2005) Videogame Addiction: Does It Exist? *Handbook Of Computer Game Studies*. J. Goldstein, J. Raessens (Eds), Boston. MIT Pres, s.359- 68.
- Griffiths MD, Meredith A (2009) Videogame addiction and its treatment. *J Contemp Psychother* 39:247-53.
- Grüsser SM, Thalemann C, Griffiths M (2007) Excessive computer game playing: Evidence for addiction and aggression? *Cyberpsychol Behav* 10:290-2.
- Güllü M, Arslan C, Dündar A et al (2012) İlköğretim öğrencilerinin bilgisayar oyun bağımlılıklarının incelenmesi. *Adıyaman Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 5:89-100.
- Güneş A (2012) Dijital oyunların güvenlik bağlamında yasal ve yönetsel düzenleme sorunları. Unpublished master's thesis. Police Academy Security Sciences Institute.
- Gürçan A, Özhan UYS, Uslu UYR (2008) Dijital oyunlar ve çocuklar üzerindeki etkileri. *Başbakanlık Aile ve Sosyal Araştırmalar Genel Müdürlüğü*, Ankara. s.1-50.
- Han DH, Hwang JW, Renshaw PF (2010a) Bupropion sustained release treatment decreases craving for video games and cue-induced brain activity in patients with Internet video game addiction. *Exp Clin Psychopharmacol* 18:297-304.
- Han DH, Kim YS, Lee YS et al (2010b) Changes in cue-induced, prefrontal cortex activity with video-game play. *Cyberpsychol Behav Soc Netw* 13:655-61.
- Han DH, Lee YS, Yang KC et al (2007) Dopamine genes and reward dependence in adolescents with excessive internet video game play. *J Addict Med* 1:133-8.
- Han DH, Lyoo IK, Renshaw PF (2012) Differential regional gray matter volumes in patients with on-line game addiction and professional gamers. *J Psychiatr Res* 46:507-15.
- Hasan Y, Bègue L, Scharkow M et al (2013) The more you play, the more aggressive you become: A long-term experimental study of cumulative violent video game effects on hostile expectations and aggressive behavior. *J Exp Soc Psychol* 49:224-7.
- Hoefl F, Watson CL, Kesler SR et al (2008) Gender differences in the mesocorticolimbic system during computer game-play. *J Psychiatr Res* 42:253-8.
- Homer BD, Hayward EO, Frye J et al (2012) Gender and player characteristics in video game play of preadolescents. *Comput Human Behav* 28:1782-9.
- Horzum MB (2011) İlköğretim öğrencilerinin bilgisayar oyunu bağımlılık düzeylerinin çeşitli değişkenlere göre incelenmesi. *Eğitim ve Bilim* 36:56-68.
- Horzum MB, Ayas T, Balta ÖÇ (2008) Çocuklar için bilgisayar oyun bağımlılığı ölçeği. *Türk Psikolojik Danışma ve Rehberlik Dergisi* 3:76-88.
- Hummer TA, Wang Y, Kronenberger WG et al (2010) Short-term violent video game play by adolescents alters prefrontal activity during cognitive inhibition. *Media Psychol* 13:136-54.
- Hur MH (2006) Demographic, habitual, and socioeconomic determinants of internet addiction disorder: an empirical study of Korean teenagers. *Cyberpsychol Behav* 9:514-25.
- Irmak AY (2014) Ortaöğretim öğrencilerinin dijital oyun oynama davranışlarının sağlık davranışı etkileşim modeline göre incelenmesi. Unpublished doctora's thesis. İstanbul University.
- Irmak AY, Erdoğan S (2015) Dijital oyun bağımlılığı ölçeği Türkçe formunun geçerliliği ve güvenilirliği. *Anadolu Psikiyatri Derg* 16 (special issue 1):10-9.
- Jang KS, Hwang SY, Choi JY (2008) Internet addiction and psychiatric symptoms among Korean adolescents. *J Sch Health* 78:165-71.
- Jeong EJ, Kim DH (2011) Social activities, self-efficacy, game attitudes, and game addiction. *Cyberpsychol Behav Soc Netw* 14:213-21.
- Kaya AB (2013) Çevrimiçi oyun bağımlılığı ölçeğinin geliştirilmesi: Geçerlik ve güvenilirlik çalışması. Unpublished master's thesis. Gaziosmanpaşa University.
- King DL, Gradisar M, Drummond A et al (2013) The impact of prolonged violent video-gaming on adolescent sleep: An experimental study. *J Sleep Res* 2:137-43.
- Ko C, Yen J, Chen C et al (2005) Gender differences and related factors affecting online gaming addiction among Taiwanese adolescents. *J Nerv Ment Dis* 193:273-7.
- Ko CH (2014) Internet gaming disorder. *Curr Addict Rep* 1: 177-85.
- Ko CH, Hsieh TJ, Chen CY et al (2014) Altered brain activation during response inhibition and error processing in subjects with Internet gaming disorder: A functional magnetic imaging study. *Eur Arch Psychiatry Clin Neurosci* 264: 661-72.
- Ko CH, Liu GC, Hsiao S et al (2009) Brain activities associated with gaming urge of online gaming addiction. *J Psychiatr Res* 43:739-47.
- Koeppe MJ, Gunn RN, Lawrence AD et al (1998) Evidence for striatal dopamine release during a video game. *Nature* 393:266-8.
- Kupfer DJ, Regier DA (2011) Neuroscience, clinical evidence, and the future of psychiatric classification in DSM-5. *Am J Psychiatry* 168:1-3.
- Kuss DJ (2013) Internet gaming addiction: current perspectives. *Psychol Res Behav Manag* 6:125-37.
- Kuss DJ, Griffiths MD (2012a) Internet and gaming addiction: A systematic literature review of neuroimaging studies. *Brain Sci* 2:347-74.
- Kuss DL, Griffiths MD (2012b) Internet gaming addiction: A systematic review of empirical research. *Int J Ment Health Addict* 10:278-96.
- Lam LT, Peng ZW (2010) Effect of pathological use of the internet on adolescent mental health: A prospective study. *Arch Pediatr Adolesc Med* 164:901-6.
- Lemmens JS, Valkenburg PM, Peter J (2009) Development and validation of a game addiction scale for adolescents. *Media Psychol* 12(Suppl.1): 77-95.
- Leung L (2004) Net-generation attributes and seductive properties of the internet as predictors of online activities and internet addiction. *Cyberpsychol Behav* 7: 333-48.
- Lin MP, Ko HC, Wu JYW (2011) Prevalence and psychosocial risk factors associated with internet addiction in a nationally representative sample of college students in Taiwan. *Cyberpsychol Behav Soc Netw* 14:741-6.
- Liu M, Peng W (2009) Cognitive and psychological predictors of the negative outcomes associated with playing MMOGs (massively multiplayer online games). *Comput Human Behav* 25:1306-11.
- Manteghi M (2002) *Study The Consequences Computer And Video Games*. Publisher: contemporary culture. Tehran, Iran.
- Mentzoni RA, Brunborg GS, Molde H et al (2011) Problematic video game use: Estimated prevalence and associations with mental and physical health. *Cyberpsychol Behav Soc Netw* 14:591-6.

- Montag C, Weber B, Trautner P et al (2012) Does excessive play of violent first-person-shooter-video-games dampen brain activity in response to emotional stimuli?. *Biol Psychol* 89:107-11.
- Möller I, Krahé B (2009) Exposure to violent video games and aggression in German adolescents: A longitudinal analysis. *Aggress Behav* 35:75-89.
- Narvaez D, Mattan B, MacMichael C et al (2008) Kill bandits, collect gold or save the dying: The effects of playing a prosocial video game. *Media Psychology Review*, 1(1). Retrieved
- 19 December 2014, from http://mprcenter.org/mpr/index.php?option=com_content&view=article&id=35&Itemid=121
- Ng BD, Wiemer-Hastings P (2005) Addiction to the internet and online gaming. *Cyberpsychol Behav* 8:110-3.
- Olson CK, Kutner LA, Baer L et al (2009) M-rated video games and aggressive or problem behavior among young adolescents. *Appl Dev Sci* 13:188-98.
- Ögel K (2012) İnternet Bağımlılığı, İnternetin Psikolojisini Anlamak ve Bağımlılıkla Başa Çıkmak. *Türkiye İş Bankası Kültür Yayınları*, p.47-60.
- Pala FK, Erdem M (2011) Dijital oyun tercihi ve oyun tercih nedeni ile cinsiyet, sınıf düzeyi ve öğrenme stili arasındaki ilişkiler üzerine bir çalışma. *Ahi Evran Üniversitesi Eğitim Fakültesi Dergisi* 12:53-71.
- Phan MH (2011) Video gaming trends: violent, action/adventure games are most popular. *Usability News* 13:2(1).
- Poli R, Agrimi E (2012) Internet addiction disorder: Prevalence in an Italian student population. *Nord J Psychiatry* 66:55-9.
- Polman H, Castro BO, Aken M (2008) Experimental study of the differential effects of playing versus watching violent video games on children's aggressive behavior. *Aggress Behav* 34:256-64.
- Porter G, Starcevic V, Berle D et al (2010) Recognizing problem video game use. *Aust N Z J Psychiatry* 44:120-8.
- Prot S, Anderson CA, Gentile DA et al (2014) The Positive And Negative Effects Of Video Game Play. *Children And Media*. A. Jordan, D. Romer (Eds) New York. Oxford University Press s.109-28.
- Quaiser-Pohl C, Geiser C, Lehmann W (2006) The relationship between computer-game preference, gender and mental-rotation ability. *Personality and Individual Differences* 40:609-19.
- Rideout VJ, Foehr UG, Roberts DF (2010) Generation M2: Media in the lives of 8- to 18- year olds. Kaiser Family Foundation. Retrieved December 19 2014, from <http://www.kff.org/entmedia/entmedia012010nr.com>
- Setir MA, Bartholow BD (2010) Violent and nonviolent video games produce opposing effects on aggressive and prosocial outcomes. *J Exp Soc Psychol* 46:934-42.
- Sharif I, Sargent JD (2006) Association between television, movie, and video game exposure and school performance. *Pediatrics* 118:e1061-70.
- Soper WB, Miller MJ (1983) Junk-time junkies: An emerging addiction among students. *The Sch Couns* 31:40-3.
- Starcevic V, Berle D, Porter G et al (2011) Problem video game use and dimensions of psychopathology. *Int J Ment Health Addict* 9:248-56.
- Tanner L (2007) AMA considers video game overuse an addiction. Retrieved 19 December 2014, from <http://www.washingtonpost.com/wpdyn/content/article/2007/06/27/AR2007062700995.html>
- Thalemann R, Wolfing K, Grüsser SM (2007) Specific cue reactivity on computer game-related cues in excessive gamers. *Behav Neurosci* 21:614-8.
- Van Rooij AJ, Schoenmakers TM, Vermulst AA et al (2011) Online video game addiction: Identification of addicted adolescent gamers. *Addiction* 106:205-12.
- Wack E, Tantleff-Dunn S (2009) Relationships between electronic game play, obesity, and psychosocial functioning in young men. *Cyberpsychol Behav* 12:241-4.
- Wan CS, Chiou WB (2006) Psychological motives and online games addiction: A test of flow theory and humanistic needs theory for Taiwanese adolescents. *Cyberpsychol Behav* 9:317-24.
- Wan CS, Chiou WB (2007) The motivations of adolescents who are addicted to online games: A cognitive perspective. *Adolescence* 42:179-97.
- Wang LC, Chen MP (2010) The effects of game strategy and preference-matching on flow experience and programming performance in game-based learning. *Innovations in Education and Teaching International* 47:39-52.
- Wang Y, Mathews VP, Kalnin AJ et al (2009) Short term exposure to a violent video game induces changes in frontolimbic circuitry in adolescents. *Brain Imaging Behav* 3:38-50.
- Williams D, Kennedy TLM, Moore RJ (2011) Behind the avatar: The patterns, practices, and functions of role playing in MMOs. *Games and Culture* 6:171-200.
- Wood RTA (2008) Problems with the concept of video game "addiction": Some case study examples. *Int J Ment Health Addiction* 6:169-78.
- Yee N (2006) Motivations for play in online games. *Cyberpsychol Behav* 9:772-5.
- Young KS (2009) Understanding online gaming addiction and treatment issues for adolescents. *Am J Fam Ther* 37:355-72.