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Why Do Some People Become Addicted to Digital Games More Easily? A Study of Digital Game Addiction from a Psychosocial Health Perspective

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ABSTRACT

Exploring digital game addiction from a psychosocial perspective has gained much attention because digital game addiction is a serious social computing issue related to public health. A number of studies have empirically tested the effects of depression and loneliness on aggression, but few studies have explored the relationships among the psychosocial constructs (i.e., depression, loneliness, and aggression) and their effects on game addiction. In addition, the mediating role of aggression in digital game addiction has neither been proposed nor empirically tested. Moreover, although the psychological constructs related to game addiction have been proposed as multidimensional concepts and digital game addiction itself has been suggested as a multidimensional construct, few studies have been proposed and conducted using multidimensional constructs. This study sought to fill these gaps by proposing an integrated model of digital game addiction from a psychosocial health perspective. In particular, this study had three objectives: (1) to propose a second-order game addiction model addressing the relationships among loneliness, depression, aggression, and game addiction as multidimensional constructs and presenting aggression as a mediator between other psychosocial constructs and game addiction; (2) to empirically validate the proposed model using survey data obtained from actual online game users; and (3) to provide new insights for game policymakers in dealing with the digital game addiction issues. Based on the empirical findings, the theoretical contributions and practical implications are discussed herein.

1. Introduction

Digital gaming tends to attract increasing amounts of time, money, and energy from the game players, which in turn may bring about negative life outcomes such as game addiction. Digital game addiction has become a social issue of late related to public health. Many previous studies reported that game addicts find it difficult to manage their daily life due to their psychological and social problems (Griffiths & Meredith, 2009; Kuss & Griffiths, 2012; Liu & Peng, 2009). Such problems seem to be very serious for young game users, which has drawn the attention of policymakers (APA, 2013; Griffiths, Davies, & Chappell, 2004).

Accordingly, a variety of perspectives and approaches have been used to assess the driving factors of digital game addiction. The previous game addiction studies focused on various factors (e.g., motivations for playing, personality traits, structural characteristics of the game, cultural and social factors, etc.) that predispose people to develop game addiction (Kuss & Griffiths, 2012). Recently, several researchers suggested that psychosocial factors such as aggression, depression, and loneliness may induce individuals to become addicted to online games (Kim, Namkoong, Ku, & Kim, 2008; Lemmens, Valkenburg, & Peter, 2011; Mehroof & Griffiths, 2010; Mentzoni et al., 2011; Peng & Liu, 2010; Seay & Kraut, 2007). Although exploring online game addiction from a psychosocial perspective has attracted the attention of scholars, it is still in its early stage (Billieux et al., 2011). There have been a number of studies that empirically tested the effects of depression and loneliness on aggression (Busch, 2009; Check, Perlman, & Malamuth, 1985; Diamant & Windholz, 1981; Dutton & Karakanta, 2013; Ji & Jang, 2010; Loucks, 1980; Roland, 2002; Zilboorg, 1938), but few studies have explored the relationships among the psychosocial constructs (i.e., depression, loneliness, and aggression) and their effects on game addiction. Especially, the mediating role of aggression in digital game addiction has neither been proposed nor empirically tested.

Moreover, a number of previous studies reported that the psychosocial constructs that are related to game addiction are multidimensional concepts (e.g., Buss & Perry, 1992; Radloff, 1977; Russell, 1996). Game addiction itself has also been suggested as a multidimensional construct (Widyanto & McMurran, 2004). Despite the multidimensionality of these constructs, to the best of our knowledge, no study has investigated the relationships between these psychosocial factors (i.e., loneliness, depression, and aggression) and digital game addiction as multidimensional constructs. This study sought to fill these gaps by proposing an integrated model of digital game addiction from a psychosocial health perspective. In particular, this study had three objectives: (1) to propose a second-order game addiction model addressing the relationships among loneliness, depression, aggression, and game addiction as multidimensional constructs and aggression as

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a mediator between other psychosocial constructs and game addiction; (2) to empirically validate the proposed model using survey data obtained from actual online game users; and (3) to provide new insights for game policymakers in dealing with the digital game addiction issues. We examine the integrated model of the psychosocial factors and game addiction as multidimensional constructs from the data of 789 sample collected in South Korea

The structure of this article is as follows. In the next section, along with literature reviews of previous studies on game addiction and other psychosocially relevant constructs, the proposed research model with several hypotheses that depict the relationships between psychosocial factors and digital game addiction from a psychosocial health perspective is presented. Section 3 discusses the research methodology, including the development of measures and the data collection procedure. Section 4 reports the details of the data analyses and the results. In the final section, the article concludes with a discussion of the findings, implications, and directions for further research.

2. Literature Review and Hypothesis Development

A negative consequence of digital games is game addiction, which generally refers to the excessive or compulsive use of computer games that results in negative consequences and unhealthy daily life behaviors (Jeong & Kim, 2011). In different studies, different terms are used to refer to it: "problematic game use" (Seay & Kraut, 2007; Tejeiro Salguero & Morán., 2002), "problematic gaming" (Griffiths, Kiraly, Pontes, & Demetrovics, 2014), "pathological video gaming" (Choo et al., 2010; Gentile, 2009; Lemmens et al., 2011), "Internet gaming addiction" (Kuss & Griffiths, 2012), "Internet gaming disorder" (APA, 2013), and "gaming addiction" (Lemmens, Valkenburg, & Peter, 2009; Van Rooij, Schoenmakers, Vermulst, Van Den Eijnden, & Van De Mheen, 2011). Recently, the American Psychiatric Association (APA, 2013) encouraged further research to determine if game addiction should be considered a pathological disorder. To date, game addiction or IGD (Internet Gaming Disorder) has been included in section III of DSM-5 (Diagnostic and Statistical Manual of Mental Disorders 5th Version, May 2013) as a condition for additional study (APA, 2013).

Rather than "addiction," some scholars (LaRose, Lin, & Eastin, 2003) suggest that the term "deficient self-regulation" may be appropriate for describing habitual Internet game usage based on the finding that the number of people who are truly addicted to Internet games is very small. They argued that the term "addiction" should be used with caution because it may be used as a means to create a sense of insecurity about psychological matters with the purpose of warning the public. Likewise, Kuss and Griffiths (2012) concurred with the aforementioned view and said that the term "addiction" must be applied only when significant negative consequences of excessive gaming arise. From this perspective, some scholars have struggled to provide a standard set of criteria for distinguishing addiction from high engagement. For instance, based on Brown's components model of addiction (Brown, 1991, 1993), Charlton and Danforth (2007) consider cognitive salience, euphoria, and tolerance peripheral symptoms and regard conflict, relapse, (behavioral) salience, and withdrawal as core criteria in defining game addiction. They said that peripheral symptoms are constructs that appear in both high engagement and pathological gaming (Charlton & Danforth, 2007). Thus, they concluded that it could be called "addiction" when the core criteria become apparent in an apparent period of time. Among these constructs, Liu and Peng (2009) found that withdrawal primarily represents the psychological condition of people with regard to massively multiplayer online role-playing game (MMORPG) dependency. Griffiths and Meredith (2009) also provided a useful basis for differentiating excessive activity from addictive activity: they said that "healthy excessive enthusiasm adds to life whereas addiction takes away from it." According to Yee (2006), who conducted an online survey to investigate gaming motivations, the reasons for individuals' engagement in MMORPGs can be subsumed under the key aspects of a sense of accomplishment through the game, social activities, and an immersive virtual environment. The said author also found that the gaming motivations such as escapism and achievement in the context of the game appeared as significant predictors of problematic gaming.

Despite the fact that excessive engagement with digital games appears to lead to game addiction, there is a general agreement that it is active involvement in networked online gaming that particularly does (Lee, Jeong, Park, & Ryu, 2011). Especially, MMORPGs may be more problematic for at-risk individuals than other game types (Chappell, Eatough, Davies, & Griffiths, 2006; Griffiths, 2009; Khan & Kanof, 2007; Lee et al., 2006). This is because intense involvement in MMORPGs demands great time investment (National Research Council, 1999; Ng & Wiemer-Hastings, 2005; Skinner, 1969) and potentially brings about negative outcomes in daily life for certain individuals (Billieux et al., 2011; Chuang, 2006; Smahel, Blinka, & Ledabyl, 2008). In addition, MMORPGs not only appeal to a wide range of players but also deal with fantasy, providing real-life simulation and role-playing with interactive real-time services because they are highly interactive, social, and competitive (Billieux et al., 2011; Charlton & Danforth, 2007; Karim & Chaudhri, 2012; Kuss, Louws, & Wiers, 2012; Morahan-Martin & Schumacher, 2000; Moser & Fang, 2015; Nagygyörgy et al., 2013; Ng & Wiemer-Hastings, 2005; Smyth, 2007; Spekman, Konijn, Roelofsma, & Griffiths, 2013; Wallace, 1999; Whang & Chang, 2004). Allowing game users to choose various characters within a phantasmal world makes the players feel free from social anxiety (Mehroof & Griffiths, 2010). From a phenomenological perspective, game addiction is mainly associated with the amount of time or money spent on gaming, insufficient sleep, and lack of interpersonal relationships (Allison, von Wahlde, Shockley, & Gabbard, 2006). Wan and Chiou (2006) reported that online game addicts consider gaming a substitute source of real-life satisfaction, fulfilling their needs when they are not satisfied with their real lives. In this way, gaming becomes a vital part of their lives, which in turn brings about negative outcomes, such as psychological concerns, physical issues, and professional/academic problems (Griffiths & Meredith, 2009; Kuss & Griffiths, 2012; Liu & Peng, 2009).

Considering the aforementioned negative life outcomes of gaming addiction, scholars have regarded game addiction as a multidimensional concept. Griffiths (1998), for example, employed some criteria symptoms, such as salience (i.e., being dominated by the game), conflict (i.e., conflict with others), and withdrawal (i.e., an unpleasant emotion or physical problem

brought about by the cessation of gaming). Likewise, based on behavioral addiction, Young (1996, 1998) created a scale for the Internet Addiction Test (IAT) by summing up the symptoms of Internet game addiction. Adopted from the scale of IAT, Widyanto and McMurran (2004) proposed game addiction scales including six sub-dimensions: salience, excess use, neglecting work, anticipation, lack of self-control, and neglecting social life. Focusing on cognitive disorder, Liu and Peng (2009) proposed multidimensional scales including cognitive and behavioral factors such as lack of control, neglecting one's work, and social problems. In this study, digital game addiction was conceptualized using the six dimensions proposed by Widyanto and McMurran (2004). Appendix 3 summarizes the definition and literature source of each construct.

2.1. Relationship between Loneliness and Game Addiction

Loneliness refers to an unhappy and disturbing sentiment due to the absence of a companion (Peplau & Perlman, 1982), which is one of the psychological characteristics strongly associated with excessive engagement with digital games. Previous studies also suggest loneliness along with aggression and depression as antecedents of game addiction (Kim, LaRose, & Peng, 2009; Lemmens et al., 2011; Mentzoni et al., 2011; Peng & Liu, 2010; Seay & Kraut, 2007; Wenzel, Bakken, Johansson, Götestam, & Øren, 2009). Although it is generally assumed that loneliness is related to social isolation, people can be lonely even when they are surrounded by other people. Accordingly, the qualitative aspects of social relationships may be more closely connected to loneliness than the quantitative ones (Hawkley, Burleson, Berntson, & Cacioppo, 2003; Hawkley, Thisted, & Cacioppo, 2009; Peplau & Perlman, 1982; Russell, Peplau, & Cutrona, 1980). Several prior studies have demonstrated that loneliness is positively associated with pathological gaming. For example, a cross-sectional study conducted by Kim et al. (2009) indicates a reciprocal relation between pathological gaming and loneliness. Lemmens et al. (2011) showed that loneliness and low social competence are significant predictors of pathological gaming, but that loneliness is the strongest predictor.

Individuals who suffer from psychological issues such as loneliness may lack social skills and may have low social competence in real life (Caplan, 2003). To fulfill their needs that are not met in real life, or to escape from negative moods, they are more likely to play online games (Caplan, 2003). In addition, they tend to manifest maladaptive cognitive distortions about themselves and the world or their ability both online and offline (Davis, 2001). As such, they are likely to feel more confident with the online environment (Caplan, 2003). Consequently, emotionally susceptible individuals may be deeply immersed in digital games. In sum, individuals suffering from loneliness may prefer playing computer games in a virtual environment rather than having face-to-face contact with people as a way to fulfill their needs that cannot be met in the real world (Liu & Peng, 2009). Therefore, the following is posited:

H1: Loneliness is positively associated with digital game addiction.

2.2. Relationship between Depression and Game Addiction

Depression is another significant psychological characteristic linked to online gaming dependency or problematic Internet use (Kim et al., 2009; Lemmens et al., 2011; Mentzoni et al., 2011; Peng & Liu, 2010; Seay & Kraut, 2007; Wenzel et al., 2009). According to the National Institute of Mental Health (NIMH, 2015), depression involves signs and symptoms such as persistent feelings of sadness, anxiety, pessimism, emptiness, hopelessness, or guilt.

The relationship between depression and game addiction has been studied by many researchers (Mentzoni et al., 2011; Peng & Liu, 2010; Seay & Kraut, 2007; Wenzel et al., 2009). Davis (2001) proposed a cognitive behavioral model of problematic Internet use and explains that "a vicious cycle of cognitive distortions and reinforcement" causes behaviors that bring out problematic issues as a consequence of spending a large amount of time online. The key traits in Davis's cognitive-behavioral model are "maladaptive cognitive pervasions" about the self and the world in the online and offline spaces (Davis, 2001); he argued that lonely and depressed people may have a devalued perception of the self and the world while having positive views of their online self and the online world. Based on Davis's model, Caplan (2003) argued that depressed individuals may have difficulty forming and maintaining social relationships involving face-to-face contact. Thus, computer-mediated environments may appeal to lonely and depressed people who have low social competence. This is because they are likely to feel "safer, more efficacious, more confident, and more comfortable with online interpersonal interactions and relationships" rather than with face-to-face social activity (Caplan, 2003).

Employing a cognitive behavioral model of problematic Internet use (Davis, 2001) and Caplan's model (Caplan, 2003) as a theoretical framework, Peng and Liu (2010) showed that depression is positively related to online gaming dependency. Mentzoni et al. (2011) also found an association between the problematic use of video games and high levels of anxiety and depression with low life satisfaction. Similarly, Wenzel et al. (2009) identified positive links between frequent video gaming and depression, self-reported sleep problems, suicidal ideation, anxiety, obsession, and compulsion. Seay and Kraut (2007) and LaRose et al. (2003) demonstrated that depression or the media habits formed to escape from blue moods diminish the effects of self-regulation. Deficient self-regulation leads to a problematic online gaming frequency or media behavior based on the frameworks originating from Bandura's social cognitive theory of personality (Bandura, 1999). According to Bandura's social cognitive theory, depression may weaken self-regulation because depressed individuals tend to devaluate their abilities.

Overall, the aforementioned findings from prior studies suggest that depression may be positively associated with game addiction. Depressed people may perceive playing digital games as a way to relieve their negative feelings. In sum, psychosocially distressed people have a preference for digital games and other online social interactions due to their negative perceptions of their social competence, which leads to excessive and compulsive digital game involvement and

digital game addiction as negative life consequences. Thus, the following is posited:

H2: Depression is positively associated with digital game addiction.

2.3. Relationship between Aggression and Game Addiction

Along with depression and loneliness, aggression is one of the most discussed psychological variables associated with gaming addiction. According to previous studies (Griffiths, 2000; Kim et al., 2008; Lemmens et al., 2011; Mehroof & Griffiths, 2010), aggression is regarded as one of the significant predictors of problematic gaming. Individuals with aggression tend to excessively play digital games, including video games. There are some explanations for this association. One view is that players may choose certain forms of media corresponding to their pre-existing traits, such as aggression, which means that searching for a particular type of game is regarded as "an active process, not a passive one" (Ferguson, 2011). Another explanation is that players' aggressive behavior may be repeated as they get rewards such as high scores for game violence, and this aggressive tendency may cause excessive or addictive play (Mehroof & Griffiths, 2010). In this process, aggressive behaviors may become "goal-directed."

Previous studies have reposted the theoretical linkages between aggression and game-addiction-related behaviors: (1) the trait of aggression is associated with a higher online game addiction score based on a framework cited from the trait theory (Griffiths, 2000; Kim et al., 2008; Lemmens et al., 2011; Mehroof & Griffiths, 2010); (2) aggressive behavior may play a role in fostering the development of online gaming addiction (Mehroof & Griffiths, 2010); (3) the preference for violent games is strongly associated with excessive game use (Griffiths et al., 2004; Griffiths & Hunt, 1995; Grüsser, Thalemann, & Griffiths, 2006; Ko, Yen, Liu, Huang, & Yen, 2009; Lemmens, Bushman, & Konijn, 2006); (4) excessive adolescent male players prefer to play violent video games (Lemmens et al., 2011); and (5) aggressive children are attracted to violent games (Griffiths, 2000).

According to Anderson and Bushman (2002), "human aggression is any behavior directed toward another individual that is carried out with the proximate (immediate) intent of causing harm" (Anderson & Bushman, 2002). They argue that the assaulter is certainly aware that the target will be damaged by his or her behavior, and that the target is actuated to avoid the action (Anderson & Bushman, 2002; Baron & Richardson., 1994; Berkowitz, 1993; Bushman & Anderson, 2001; Geen, 2001). For aggressive people, their aggressive tendency to easily become anxious and aroused can make it difficult for them to interact with others (Crick & Grotpeter, 1995; Ferris & Grisso, 1996). Lacking social interaction, they may indulge in playing online games as a means to solve their problem (Wan & Chiou, 2006).

Furthermore, people who tend to be aggressive may look for certain types of games, such as those that involve shooting or an action that matches their disposition (Griffiths, 2000; Lemmens et al., 2011). Previous studies have reported that the preference for violent games is positively associated with excessive game use (Griffiths et al., 2004; Griffiths & Hunt, 1995; Grüsser et al., 2006; Ko et al., 2009; Lemmens et al., 2006; Mehroof & Griffiths, 2010). As players receive rewards for their aggressive behavior, game violence is more likely to be repeated for an accomplishment in the context of the game (Mehroof & Griffiths, 2010). As such, game players may become deeply immersed in game play. In particular, considering that most game players who enjoy online social games such as MMORPGs and shooting, fighting, and adventure games, where the players should shoot monsters for item collection or kill opponents for the accomplishment of rising to a higher level (KOCCA, 2015), user aggression can be one of the primary antecedents to game addiction. Thus, the following hypothesis is proposed:

H3: Aggression is positively associated with digital game addiction.

2.4. Depression and Loneliness as Driving Factors for Aggression

Many studies have claimed that individuals who are lonely and/or depressed have aggressive behavioral tendencies, including general hostility (Diamant & Windholz, 1981), anger-hostility (Loucks, 1980), aggressive expression (Check et al., 1985), and aggressive behaviors (Zilboorg, 1938). From the perspective of social skills (Jones, 1982), Check et al. (1985) explain how the relationship between loneliness and hostility is formed. Lonely individuals are deficient in social skills, with a biased view/perception and judgment of their performance in social interactions (Check et al., 1985; Jones, Freemon, & Goswick, 1981). For this reason, lonely people tend to have little interest in others (Brennan, 1982; Jones, 1982) and tend to lack social relationships (Check et al., 1985). This may result in "rejection and subsequent social isolation," which may trigger "extreme and negative reactions to such rejection" (Check et al., 1985).

In a similar vein, a psychodynamic formulation for depression has indicated its association with aggression. According to Busch (2009), people inclined to feel the blues may be sensitive and vulnerable to loss or social rejection (Busch, 2009; Busch, Rudden, & Shapiro, 2004; Rudden et al., 2003). This sensitivity develops with an individual's experience of "feelings of sadness and unlovability, disappointment and helplessness, and rejection" in his or her early days; in turn, these negative experiences often provoke angry reactions to other people (Busch, 2009). This anger toward others often induces guilt feelings and becomes directed at the self, which in turn causes one's self-esteem to drop, completing "a vicious cycle of depression" (Busch, 2009). Morrow, Hubbard, McAuliffe, Rubin, & Dearing (2006) indicated that peer rejection is directly associated with reactive aggression and depression.

Many researchers have reported that depression is linked to general aggression, spousal aggression, spousal homicide, child abuse, and aggression to the self (Dutton & Karakanta, 2013). For instance, Roland (2002) distinguishes reactive and proactive aggressiveness and finds a significant relationship between self-reported depressive symptoms and proactive aggressiveness. He thinks that proactive aggressiveness is a motivator that triggers bullying behavior. In another study, Ji and Jang (2010) provided evidence that depression is a significant contributor to aggression for elementary students.

They consider children's aggressive behavior a feature of depression, and view depression as a form of aggression toward the self. Busch (2009) concluded that anger is a salient trait of depression by investigating several studies that generally indicate a close link between anger and depression. In addition, Ko et al. (2009) considered depression one of the shared associated factors for predicting aggression for young adolescents in their study, which evaluated the association between Internet addiction and aggressive behavior. Dutton and Karakanta (2013) argued that depression should be considered a risk indicator of aggression based on a critical review of previous empirical studies. Dodge and Coie (1987) also found an association between depression and the hostile-impulsive-uncontrolled kind of aggression.

In sum, as noted in the foregoing, depression and loneliness are closely associated with aggression and are considered influential predictors of aggression. Depressed and/or lonely individuals may experience negative feelings such as disappointment, sadness, powerlessness, rejection, and helplessness from social rejection or social exclusion in childhood due to their lack of social skills (Busch, 2009) or little interest in others (Brennan, 1982; Jones, 1982). They are likely to be vulnerable to such social situation (Busch, 2009). Therefore, these accumulated experiences may trigger anger or hostility toward others or the self (Busch, 2009; Check et al., 1985). Especially for children and young adolescents, aggression can be considered to follow from depression (Ji & Jang, 2010). Based on these findings and arguments, the following are posited:

H4: Loneliness is positively associated with aggression.

H5: Depression is positively associated with aggression.

2.5. Research Model

Based on the proposed hypotheses, a nomological network depicting the proposed research model of the study was drawn (see Figure 1). The underlying logic of the nomological network is that multidimensional psychosocial constructs such as depression, loneliness, and aggression may entail problematic digital game use (i.e., digital game addiction), and depression and loneliness can be considered driving factors for aggression as prior studies revealed that aggression is linked to both depression and loneliness. Along with these psychosocial factors, the study considered the game players' age, average game time per day, and education level control variables to determine if these have an effect on the main research constructs.

3. Research Methodology

3.1. Instrument Development

Following the recommendation on instrument development by Bentler and Chou (1987), each construct was measured by multiple measurement items; multiple measures provide a more accurate representation of the concept of construct

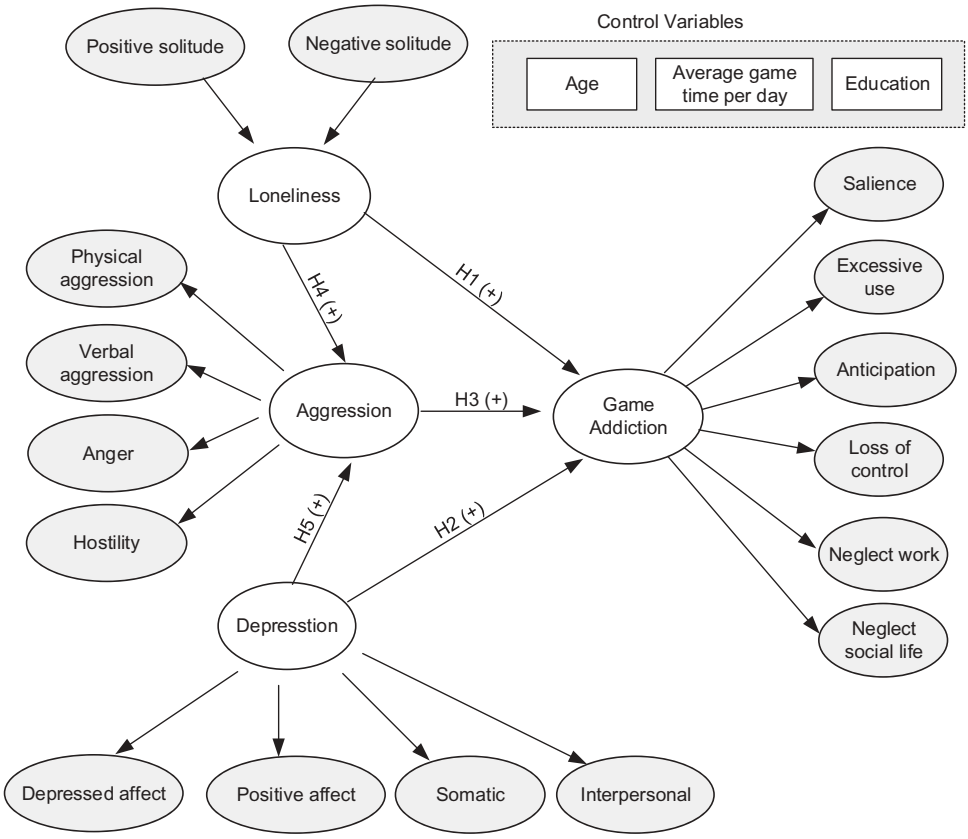

Figure 1. Research model.

and are typically downward-based in measurement error when multiple regression analysis is applied (Bentler & Chou, 1987). Most items were adapted from prior studies: game addiction, aggression, loneliness, and depression were adopted from the Young's Internet Addiction Test (IAT) Scale, the Buss-Perry Aggression Questionnaire, the UCLA Loneliness Scale, and the short form of the Center for Epidemiological Studies Depression (CESD) Scale, respectively. They were revised to fit the context of the study and were written in the form of questions or statements to be answered based on a 5-point Likert scale where 1 means "strongly disagree" and 5 "strongly agree" (Tourangeau, Rips, & Rasinski, 2000). Appendix 1 summarizes all the developed measurement items, and the details of the development process follow.

Game addiction is measured with a modified version of Young's Internet Addiction Test (IAT) (Young, 1998) to measure the individual degree of game addiction. The original 20 items were revised according to the context of game use instead of Internet use (e.g., I play games longer than I intend to; I snap, yell, or act annoyed if someone bothers me while I'm playing games). The revised version has also been used in previous studies (Jeong & Kim, 2011). Pertaining to subfactors, Widyanto and McMurran (2004) indicated a six-factor structure with good internal consistency. The six factors are salience, excess use, neglecting work, anticipation, lack of self-control, and neglecting social life. Each construct shows high reliability (see Table 1). As for loneliness, the 20-item UCLA Loneliness Scale was used to access the level of loneliness (Russell, 1996). Some examples of the items are "How often do you feel that you are no longer close to anyone?" and "How often do you feel that your interests and ideas are not shared by those around you?" With regard to the factors of the UCLA Loneliness Scale (Version 3), Knight, Chisholm, Marsh, and Godfrey (1988) and Miller and Cleary (1993) verified two factors involving positive (non-lonely) and negative (lonely) items. Later using two method factors, Russell (1996) found that a bipolar global loneliness factor provided a satisfactory fit to their data through confirmatory factor-analytic procedures. In this article, considering the bipolar global loneliness concept, we measure loneliness as a higher-order formative construct consists of two first-order constructs (i.e., positive loneliness and negative loneliness).

For depression, 11 items were used to access the depression level. CESD-11 is a short form of the Center for Epidemiological Studies Depression Scale. According to Radloff (1977), depression can be explained based on four aspects: depressed affect (blues, depressed, lonely, crying, sad), positive affect (good, hopeful, happy, enjoying), somatic and retarded activity (bothered, appetite, effort, sleep, getting going); interpersonal (unfriendly, disliking). As for aggression, it was measured with 29 items from the aggression questionnaire by Buss and Perry (1992). With respect to the sub-traits of aggression, four components were yielded from factor analysis. They identified that aggression consists of four scales: physical aggression, verbal aggression, anger, and hostility. Some demographic questions, such as those pertaining to age, sex, and occupation, were also added.

3.2. Data Collection

A total of 800 sample who had played any digital games (e.g., video games, offline computer games, internet games, smartphone games, arcade games, etc.) before were surveyed in South Korea. The survey was conducted with the help of a professional survey research company[1] in Korea. A quota sampling method considering the ratios of age and gender of the population in South Korea was used. Survey questions were asked via interviews. Trained interviewers with survey guidelines contacted the randomly selected individuals. After eliminating incomplete respondents, 789 sample were analyzed: Among them, 395 (50.1%) of the participants were males, and ages ranged from 16 to 59 years (M = 38.8, SD = 11.9). Among the participants, 83.9% played online games, including MMORPGs, shooting, action, adventure, and social network games. As a reward, all participants received 5,000 KRW (about 5 USD) for their involvement in the survey.

4. Data Analysis and Results

To validate the proposed research model, SmartPLS Version 2.0.M3, a component-based partial least squares (PLS) structural equation modeling technique, was used.[2] PLS is a second-generation structural equation modeling technique that takes either an exploratory approach to explain a structural model (i.e., theories) or a confirmatory (i.e., hypothesis-testing) approach to determine the causal relationships among the latent variables (Hair Jr, Hult, Ringle, & Sarstedt, 2013). The PLS methodology was chosen for several reasons: (1) it easily handles both formative and reflective measures and is capable of estimating very complex models (e.g., a higher-order model with formative and reflective measurement models); and (2) the data are non-normally distributed, with missing values. While PLS has many advantages, it also has several limitations. The major limitations are the sensitivity to the relative scaling of measurement items and a higher risk of overlooking 'real' correlations (Hair Jr et al., 2013).

Following the two-step approach, the reliability and validity of the measurement model were first examined, followed by those of the structural model, to test the proposed research hypotheses (Hair Jr et al., 2013). To take advantage of the large sample size for the better confidence level of the results of the statistical analyses (McKnight et al., 2002), the sample data were divided into two sets using the SPSS random selection method. The randomly selected first half ($n1$ = 394) of the sample were used for measurement model testing, and the

[1]We outsourced the survey project to the Hankook Research Co. (www.hrc.co.kr), which is one of top survey research companies in Korea. The survey was conducted with 20 interviewers in Seoul and its suburban areas (Gyeonggi province).

[2]SmartPLS is one of the software tools for partial least squares structural equation modeling. It has an easy to use and intuitive graphical user interface (check samrtpls.de for more details).

second half of the remaining sample ($n2$ = 395) were used for the nomological validity of structure model testing.

4.1. Measurement Model Validation

As discussed in the instrument development section, all the measurement items were adopted from prior studies, which means that they have already been tested for reliability and validity. This notwithstanding, the measurement model was tested in terms of reliability, internal consistency, convergent validity, and discriminant validity. For the reliability of the measurement model, the outer loading values were evaluated. The results of the outer loadings are reported in Appendix 2. All the measurement items, except for PS1 (−0.681) and NS5 (0.694), had outer loading values higher than the threshold value of 0.70 (Hair Jr et al., 2013). The internal consistency of the measures was assessed based on the composite reliability values, and the convergent validity was evaluated using the average variance extracted (AVE) values, and the discriminant validity through the Fornell-Larcker method (1981). The results of the reliability assessment of the multi-item measures, including Cronbach's alpha, composite reliability, and AVE, along with the values of the mean and standard deviation, are summarized in Table 1. All the constructs have higher than the suggested threshold values of 0.7 for Cronbach's alpha (Nunnally & Bernstein, 1994), 0.8 for composite reliability, and 0.5 for AVE (Chin, 1998; Fornell & Larcker, 1981; Nunnally & Bernstein, 1994), except that the AVE value of hostility was slightly lower (0.480).

To check if the measurement items of a construct were related only to that construct and not to the others in the model (discriminant validity), using the Fornell-Larcker assessment method (Fornell & Larcker, 1981), the square roots of the AVE values were compared for all the constructs, with their correlations with the other constructs. The results are summarized in Table 2. As can be seen in such table, the square root of AVE for all the constructs was higher than the correlations with the other constructs in the corresponding row and column. Thus, the Fornell-Larcker criterion provides evidence that the constructs' discriminant validity is indeed valid.

4.2. Structural Model Evaluation

The structural model was evaluated via PLS analysis using the bootstrapping process, with 1,000 resampling cases. The level of significance for each hypothesis was calculated based on the t-statistics, and for the variance explained for the endogenous variables, the value of R-square was used. The results of the PLS analysis are presented in Figure 2 with all the values of the path coefficients and R-square.

The results show that loneliness has a significant effect on online game addiction (b = .164; p < .01), supporting H1. As opposed to the authors' expectation, interestingly, the effect of depression on game addiction (b = .098, p > .05) was not significant; thus, H2 was not supported. Loneliness (b = .291, p < .01) and depression (b = .428, p < .01) had significant effects on aggression, supporting H4 and H5. In turn, aggression had a substantial effect on game addiction (b = .421; p < .01), supporting H3. The variance explained for aggression and online game addiction was about 39 and 31%, respectively; they are all above the recommended value of 10%.

4.3. Mediation Test (Depression → Aggression → Online Game Addiction)

Considering the insignificant effect of depression on game addiction, the indirect effect of depression on game addiction via aggression (i.e., the mediation effect of aggression) was tested through the Sobel test (Sobel, 1982). Following the common approach to testing a mediating effect suggested by Sobel (1982), the mediating effect of aggression between depression and game addiction was tested. When testing the mediating effects, the relationship between depression and game addiction had to be examined first and compared with the relationship between depression and game addiction, including the mediator (i.e., aggression). According to Baron and Kenny (1986), four conditions should be satisfied to confirm the mediation effect in the model: (1) the independent variable must significantly affect the dependent variable without including the mediator; (2) an independent variable should affect the

Table 1. Reliability and discriminant validity of constructs.

Constructs	# of measures	Mean (S.D.)	Cronbach Alpha	CR	AVE
Game Addiction (Reflective)					
Salience	4	2.464 (.800)	0.845	0.891	0.625
Excessive use	5	2.351 (.861)	0.873	0.908	0.663
Anticipation	2	2.342 (.873)	0.648	0.850	0.739
Lack of control	3	2.282 (.904)	0.812	0.889	0.727
Neglect work	2	2.080 (.917)	0.859	0.914	0.779
Neglect social life	2	2.026 (.867)	0.775	0.899	0.816
Loneliness (Formative)					
Positive Loneliness (R)	9	3.020 (.491)	0.900	0.919	0.559
Negative Loneliness	9	2.306 (.531)	0.914	0.929	0.566
Depression (Reflective)					
Depressed Affect	3	1.540 (.705)	0.858	0.913	0.778
Positive Affect (R)	2	2.929 (.864)	0.759	0.892	0.805
Somatic & Retarded Activity	3	1.566 (.568)	0.705	0.819	0.536
Interpersonal Factor	2	1.347(.622)	0.828	0.920	0.853
Aggression (Reflective)					
Anger	5	2.749 (.586)	0.865	0.903	0.654
Hostility	4	2.756 (.629)	0.844	0.880	0.480
Physical Aggression	7	2.403 (.619)	0.885	0.910	0.593
Verbal Aggression	3	2.859 (.633)	0.766	0.845	0.584

Note: (R)—Reverse corded, * the means and standard deviation (S.D.) of the constructs were computed by taking the means of all measurement items. CR: Composite Reliability, AVE: Average Variance Extracted

Table 2. Correlation and Discriminant Validity of Constructs.

Constructs	1	2	3	4	5	6	7	8	9	10	11	12	13	114	15	16
Salience (SA)	**0.791**															
Excessive use (EX)	0.734	**0.814**														
Neglect work (NW)	0.709	0.607	**0.883**													
Anticipation (AN)	0.609	0.674	0.758	**0.860**												
Lack of control (LC)	0.684	0.761	0.723	0.762	**0.853**											
Neglect social life (NS)	0.689	0.703	0.692	0.647	0.737	**0.903**										
Positive Loneliness (PL)*	0.119	0.118	0.105	0.102	0.200	0.157	**0.747**									
Negative Loneliness (NL)	0.258	0.245	0.235	0.203	0.278	0.240	0.558	**0.753**								
Depressed Affect (DA)	0.083	0.062	0.077	0.084	0.113	0.086	0.409	0.495	**0.882**							
Positive Affect (PA)	0.084	0.051	0.074	0.063	0.096	0.064	0.415	0.404	0.485	**0.897**						
Somatic & Retarded Activity (SOA)	0.084	0.074	0.079	0.061	0.082	0.071	0.403	0.467	0.620	0.463	**0.732**					
Interpersonal Factor (IF)	0.108	0.077	0.115	0.093	0.159	0.188	0.381	0.451	0.724	0.384	0.701	**0.923**				
Anger (AN)	0.348	0.318	0.310	0.273	0.269	0.304	0.205	0.398	0.260	0.428	0.276	0.091	**0.808**			
Hostility (HO)	0.244	0.236	0.220	0.210	0.262	0.230	0.379	0.613	0.195	0.323	0.224	0.051	0.542	**0.693**		
Physical Aggression (PH)	0.379	0.375	0.350	0.351	0.364	0.410	0.206	0.321	0.296	0.439	0.276	0.110	0.639	0.536	**0.770**	
Verbal Aggression (VA)	0.192	0.227	0.197	0.197	0.161	0.228	0.059	0.162	0.292	0.437	0.362	0.168	0.501	0.427	0.492	0.764

Note: The square root of AVE (Average Variance Extracted) is presented in bold in the diagonal cells for the corresponding construct.
* Reverse-corded

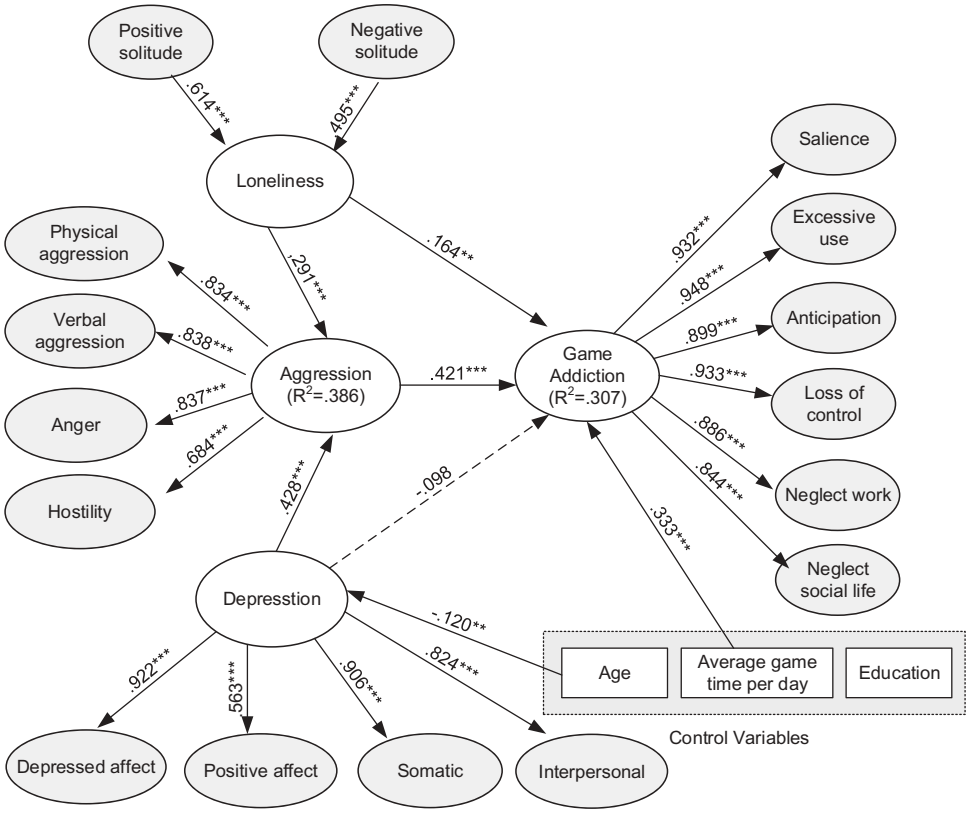

Figure 2. Research model and hypothesis.

mediator significantly; (3) the mediator must affect the dependent variable significantly; and (4) the relationship between the independent and dependent variables should be non-significant when the mediator is included.

The direct effect of depression (i.e., independent variable) should be significant if the mediator is not included in the model. Thus, the model was run without depression and the result confirmed that the path coefficient of depression on game addiction is statistically significant (b = .2487; p < .001). When aggression was included (i.e., the mediator), the path coefficient of depression on aggression was significant (b = .5835; p < .001), and the path coefficient of aggression on game addiction was also significant (b = .4836; p < .001). Interestingly, with the mediator in the model, the path coefficient of depression on game addiction became −0.0525 (p > .05), which was insignificant. The Sobel test t-statistic was 6.9048 (p < .001). Therefore, it can be concluded that aggression fully mediates the relationship between depression and game addiction.

5. Discussion

5.1. Study Findings

The first finding is that aggression plays a crucial role in predicting the degree of game addiction. Previous studies

focused on either depression or loneliness in explaining the determinants of game addiction (Lemmens et al., 2011; Peng & Liu, 2010); aggression, however, has not been highlighted in game addiction studies even though seven out of the ten hit games in the global game markets in 2015 were violent games (vgchartz, 2015). The results of this study showed that aggression was the strongest determinant of game addiction among the psychosocial variables.

People who are aggressive express their aggression through diverse channels. Online games can be one of the means for them to reveal their aggression because such games contain some aggressive elements. In particular, many multi-user online games provide a PK (player killing) system, with which one user can kill any of the other users to take items from them or just for fun (Foo & Koivisto, 2004). In addition, violent environments in which the users should kill their opponents for survival and rewards such as valuable items or scores also stimulate aggressive users to become engaged in the games (Mehroof & Griffiths, 2010).

In line with that, aggressive people are inclined to become immersed in playing online games. This could be because aggression prevents them from interacting with others. This implies that aggression could cause them to disconnect with people; thus, people who are aggressive become socially isolated. As a result, aggressive people are more likely to indulge in playing online game because they end up lacking social interaction and are in a status of social withdrawal (Check et al., 1985; Morrow et al., 2006). Thus, aggressive people can have a tendency to play online games addictively.

Both depression and loneliness showed strong associations with aggression. Considering that few studies have focused on such associations in the context of game addiction, this result also implies the important role of user aggression with regard to game addiction. Additionally, the result is consistent with those of previous studies, which showed the significant effects of loneliness and depression on aggression (Busch, 2009; Check et al., 1985; Dutton & Karakanta, 2013). Loneliness is positively associated with aggression. People who are lonely tend to show immaturity in their social interactions because they lack social skills and learning chances through experiences (Caplan, 2003, 2005; Jones, 1982). These could make them unconcerned about others and become isolated from social relationships. Furthermore, their exclusion and rejection by others and the society make them aggressive toward others and the society (Check et al., 1985). Likewise, depression is substantially associated with aggression. Depressed people tend to be susceptible and vulnerable to controlling their emotions. As such, it is difficult for depressed people to handle their aggression toward others or the society when external stimuli arouse their anger (Busch, 2009). Depressed people are sensitive to external stimuli; thus, they may react with anger when they feel socially isolated or rejected.

On game addiction, loneliness showed a positive significant effect. This result is also in line with those of previous studies. When people are socially excluded or feel lonely, they search for channels to gratify their needs or to relieve their stress (Wan & Chiou, 2006). Access to online games is a relatively easy way to satisfy one's desire or to release stress because games are channels that are close at hand. Thus, they can have frequent access to online games rather than interact with others. Especially, the more people are socially isolated, the easier they become addicted to playing online games because connecting to such games is even easier than contacting others. As Yee (2006) reported, such escapism is a key motivation to become engaged in online games. Thus, people who feel alone or are isolated from others tend to become absorbed in online games because they do not have difficulty gaining emotional satisfaction from social interaction online, and because they can readily ease their loneliness by playing online games.

Contrary to the expectation, however, depression did not show any significant effect on game addiction. People who suffer from depression are more likely to pay attention to playing games because they seek something to be absorbed in, or to be stimulated. Thus, depression seems to have a positive relationship with game addiction because playing online games functions as a means of breaking their melancholy mood. The study result showed, however, that depression is not positively associated with online game addiction.

There could be two explanations for this unexpected result. First, depression can be indirectly associated with game addiction. This was supported in this study by the mediation effect of aggression between depression and game addiction. Actually, such mediation effect was also found in some previous studies. For example, Caplan's study (Caplan, 2003) reported the mediation role of "preference for online interaction" between depression and problematic Internet addiction. Second, playing games can primarily satisfy people who became depressed due to interpersonal (i.e., social) problems. Unlike loneliness, depression seems to be associated with various factors, such as social problems and stress from failure or illness. It seems, however, that depression induced by an interpersonal problem may serve as a catalyst for seeking a substitute for real social relationships (Wan & Chiou, 2006). This was supported in this study by the results of the post hoc analysis that was conducted. Among the four subfactors of depression, only the interpersonal factor showed a significant effect on game addiction. As explained by previous studies (Busch, 2009; Check et al., 1985), social isolation or withdrawal is an important factor associated with psychological variables (i.e., depression and loneliness). Depressed people who think that people treat them coldly are likely to have negative interpersonal experiences, such as social rejection or exclusion in real life. To fulfill their social desires in real life, they may become immersed in online games.

5.2. Theoretical and Practical Contributions

This study provides several theoretical and practical contributions to the area of digital game addiction studies. From a theoretical perspective, this study offers an integrated model with three psychosocial variables (i.e., loneliness, depression, and aggression) in the context of game addiction. In addition, the model shows the important role of aggression between psychological variables and game addiction. Specifically, it exhibits the effects of loneliness and depression on aggression as determinants of game addiction. The previous models about game addiction (e.g., Davis's cognitive-behavior model) mainly focused on psychological variables such as loneliness and depression (Davis, 2001). Such models did

not pay much attention to the role of aggression in relation to game addiction. The current study provides clear results on the associations among the psychosocial variables and their effects on game addiction in the integrated model.

Next, this study considered the sub-factors of each construct in the integrated model. Even though the main variables have been used in previous studies (Kim et al., 2008; Lemmens et al., 2011; Mehroof & Griffiths, 2010; Mentzoni et al., 2011; Peng & Liu, 2010; Seay & Kraut, 2007; Wenzel et al., 2009), they were not used with each variable's sub-dimensions. In particular, as game addiction is regarded as a concept comprising addictive symptoms such as salience, excessive use, and loss of self-control, it would be necessary to consider such sub-factors in measuring the degree. In the context of game addiction studies, however, few studies have included such sub-factors in a structure model. In addition, regarding the psychosocial antecedents to game addiction, considering the sub-factors of each construct can provide much detailed results in the model. In this study, the integrated model was examined, including the sub-dimensions of each construct, and it was notably found that only the interpersonal factor of depression is associated with the degree of game addiction.

Third, this study showed the mediating role of aggression between depression and game addiction. The previous studies reported the direct effect of depression on game addiction (Mentzoni et al., 2011; Peng & Liu, 2010; Seay & Kraut, 2007; Wenzel et al., 2009), the effect of depression on aggression (Busch, 2009; Dodge & Coie, 1987; Dutton & Karakanta, 2013; Ji & Jang, 2010; Ko et al., 2009; Roland, 2002), and the effect of aggression on game addiction (Griffiths, 2000; Kim et al., 2008; Lemmens et al., 2011; Mehroof & Griffiths, 2010). In the area of game addiction studies, however, few studies have tested the mediation role of aggression. Furthermore, considering the different result for loneliness, such result also leaves further room for investigation for the future studies. More theoretical and empirical studies are needed to find more influential mediators between depression and game addiction.

From a practical perspective, this study provides hints on some relevant policies for policymakers and social activists. The results imply that social and cultural characteristics influence the online users' behavior in digital media and they should be considered in implications of game addition related regulations and policies. Specifically, the results show that loneliness and depression have an impact on aggression, and that loneliness and aggression influence the degree of game addiction. Based on these results, the psychosocial factors such as loneliness, aggression, and depression should be considered in order to prevent people from game addiction because such determinants are directly or indirectly associated with game addiction. In South Korea, it has been several years since the government administered the shutdown law, which prohibits young players under 16 from playing online games from midnight to 6 a.m. Recent research, however, reported the limited effect of such law in alleviating digital game addiction (Park, Koh, & Park, 2013). As the case of the shutdown policy shows, compulsory regulation forbidding gaming is hardly effective for game addiction.

Policymakers need to comprehensively consider social and cultural factors of game addiction to be able to handle and address the addiction problem. For example, the government can establish and operate an aggression and loneliness management center in the local neighborhoods for treating and preventing game addiction. The centers for game addicts need to pay more attention to the psychosocial factors for alleviating the addictive symptoms. In addition, local governments can encourage social interaction by operating community-level activation and cultural programs for problematic game users to promote their psychosocial health by inducing them to develop relationships with others.

5.3. Limitations

Although this research mainly focuses on the relationships among psychological variables (i.e., aggression, depression, and loneliness) and game addiction, there exist some other important antecedents and mediators of game addition including structural characteristics of the game, cultural and social factors. For example, it can be argued that aggression is positively associated with game addiction by mediating social interaction with friends and family members. Thus, the future study may consider more constructs to increase the explanatory power of game addition. For example, a future research includes both the direct relationship between social interaction and game addiction and its mediating effect on game addition.

Another limitation of this study has to do with sampling. This study was conducted in South Korea, a county with leading online game culture, where online games comprise more than 80% of the whole game market. Thus, it should be cautious to generalize the findings of the study, because such an environment can cause somewhat different and biased realities regarding game addiction. Future studies need to collect data from various countries for the generalization of the results.

6. Conclusion

Digital game addiction is now one of serious psychosocial health issues in that it is related to psychosocial factors such as loneliness, depression, and aggression. Lonely and depressed people are inclined to be immersed in games because the digital games can be a tool to solve their social problems in real life. Likewise, aggression is significantly related with both the psychological variables (loneliness and depression) and game addiction. In addition, aggression mediates the effect of depression on game addiction. Notably, aggression shows a stronger association with game addiction than those of loneliness and depression. Considered that most of blockbuster games in the recent game market are violent games and such multi-user online games provide users with violent systems (e.g., killing other users), the effect of aggression on game addiction needs to be paid more attention in the future research. In line with that, most policies related to game addiction have not focused on the psychosocial variables despite their strong relationships with game addiction. Future research related to game addiction policies needs to investigate the roles of such factors in user effects as primary determinants to the degree of game addiction.

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Appendix 1: Measurement Items

Second-order construct/Sub-Construct (Literature Source)		Measurement Items
Game Addiction	Salience (SA)	SA1. How often do you fear that life without games would be boring, empty and joyless?
		SA2. How often do you snap, yell, or act annoyed if someone bothers you while you play games?
		SA3. How often do you feel preoccupied with games when real life or fantasize about being in game world?
(Widyanto & McMurran, 2004)		SA4. How often do you choose to spend more time gaming over going out with others?
	Excessive use (EX)	EX1. How often do you lose sleep due to late night gaming?
		EX2. How often do you try to hide how long you've been gaming?
		EX3. How often do you feel depressed, moody, or nervous when you are off-line, which goes away once you are back gaming?
		EX4. How often do you find that you play games longer than you intended?
		EX5. How often do you neglect household chores to spend more time playing games?
	Neglect work (NW)	NW1. How often does your work suffer (e.g. postponing things, not meeting deadlines, etc.) because of the amount of time you spend on playing games?
		NW2. How often does your job performance or productivity suffer because of games?
	Anticipation (AT)	AT1. How often do you find yourself anticipating when you will log in games again?
		AT2. How often do you play games before something else that you need to do?
	Lack of Control (LC)	LC1. How often do you find yourself saying "Just a few more minutes" when gaming?
		LC2. How often do you try to cut down the amount of time you spend on games and fail?
		LC3. How often do others in your life complain to you about the amount of time you spend on games?
	Neglect social life (NE)	NE1. How often do you prefer excitement of game playing to intimacy with your partner?
		NE2. How often do you form new relationships with fellow game users?
Loneliness (Russell, 1996)	Positive Loneliness (PL)	PL1. How often do you feel that you are "in tune" with the people around you?
		PL2. How often do you feel part of a group of friends?
		PL3. How often do you feel that you have a lot in common with the people around you?
		PL4. How often do you feel outgoing and friendly?
		PL5. How often do you feel close to people?
		PL6. How often do you feel you can find companionship when you want it?
		PL7. How often do you feel that there are people who really understand you?
		PL8. How often do you feel that there are people you can talk to?
		PL9. How often do you feel that there are people you can turn to?
	Negative Loneliness (NL)	NL1. How often do you feel that you lack companionship?
		NL2. How often do you feel that there is no one you can turn to?
		NL3. How often do you feel alone?
		NL4. How often do you feel that you are no longer close to anyone?
		NL5. How often do you feel left out?
		NL6. How often do you feel that your relationships with others are not meaningful?
		NL7. How often do you feel that no one really knows you we11?
		NL8. How often do you feel isolated from others?
		NL9. How often do you feel that people are around you but not with you?
Depression (Radloff, 1977)	Depressed Affect (DA)	DA1. I felt depressed.
		DA2. I felt I am along
		DA3. I felt sad.
	Positive Affect (PA)	PA1. I felt that I was just as good as other people.
		PA2. I enjoyed life.
	Somatic & Retarded Activity (SO)	SO1. I did not feel like eating; my appetite was poor.
		SO2. I felt that everything I did was an effort.
		SO3. My sleep was restless.
	Interpersonal Factor (IF)	IF1. People were unfriendly.
		IF2. I felt that people disliked me.
Aggression (Buss & Perry, 1992)		AN1. Some of my friends think I'm a hothead.
		AN2. I am an even-tempered person.
	Anger (AN)	AN3. I flare up quickly but get over it quickly.
		AN4. I have trouble controlling my temper.
		AN5. Sometimes I fly off the handle for no good reason.
		HO1. When people are especially nice, I wonder what they want.
		HO2. I am suspicious of overly friendly strangers.
	Hostility (HO)	HO3. I sometimes feel that people are laughing at me behind me back.
		HO4. I know that "friends" talk about me behind my back.
		PH1. I have become so mad that I have broken things.
		PH2. Once in a while I can't control the urge to strike another person.
		PH3. I have threatened people I know.
	Physical Aggression (PH)	PH4. Given enough provocation, I may hit another person.
		PH5. If somebody hits me, I hit back.
		PH6. There are people who pushed me so far that we came to blows.
		PH7. I get into fights a little more than the average person.
		VA1. I often find myself disagreeing with people.
	Verbal Aggression (VA)	VA2. When people annoy me, I may tell them what I think of them.
		VA3. I can't help getting into arguments when people disagree with me.

Appendix 2: Outer Loadings

	SA	EX	NE	LC	NW	AN	PL	NL	AN	HO	PH	VA	IF	SO	PA	DA
SA1	0.814															
SA2	0.833															
SA3	0.841															
SA4	0.862															
EX1		0.852														
EX2		0.838														
EX3		0.842														
EX4		0.835														
EX5		0.799														
NE1			0.917													
NE2			0.885													
LC1				0.827												
LC2				0.862												
LC3				0.883												
NW1					0.910											
NW2					0.872											
NW3					0.936											
AT1						0.874										
AT2						0.856										
PL1							−0.681									
PL2							−0.841									
PL3							−0.745									
PL4							−0.784									
PL5							−0.838									
PL6							−0.789									
PL7							−0.728									
PL8							−0.731									
PL9							−0.662									
NL1								0.863								
NL2								0.681								
NL3								0.744								
NL4								0.829								
NL5								0.777								
NL6								0.694								
	SA	EX	NE	LC	NW	AT	PS	NS	AN	HO	PH	VA	IF	SO	PA	DA
NL8								0.837								
NL9								0.754								
AN1									0.667							
AN2									0.837							
AN3									0.866							
AN4									0.883							
AN5									0.764							
HO1										0.827						
HO2										0.785						
HO3										0.836						
HO4										0.858						
PH1											0.689					
PH2											0.793					
PH3											0.850					
PH4											0.834					
PH5											0.785					
PH6											0.729					
PH7											0.753					
VA1												0.790				
VA2												0.895				
VA3												0.866				
IF1													0.938			
IF2													0.928			
SO1														0.827		
SO2														0.841		
SO3														0.763		
PA1															0.946	
PA2															0.887	
DA1																0.893
DA2																0.892
DA3																0.893

Appendix 3: Research Construct and Definition

Construct	Definition	Literature Source
Salience	"Domination of a person's life by the activity" (p. 1532)	Charlton and Danforth (2007).
Excessive use	An inability to stop playing games to the point where it results in negative life consequences	Widyanto and McMurran (2004).
Neglect work	Giving insufficient attention to something that should be done	
Anticipation	Impatiently waiting for or anticipating playing games	
Lack of control	Lack of self-control in daily life	
Neglect social life	Giving little attention to social relationships in real life	
Positive Loneliness	Positively worded items (non-lonely)	Russell (1996).
Negative Loneliness	Negatively worded items (lonely)	
Depressed Affect	Depressed affect consists of feelings of "blues, depressed, lonely, cry sad (p.397)".	Radloff (1977).
Positive Affect	Positive affect consists of feelings of "good, hopeful, happy, enjoy (p.397)"	
Somatic & Retarded Activity	Somatic & retarded activity is interpretable as "bothered, appetite, effort, sleep, get going" (p.397).	
Interpersonal factor	Interpersonal factor involves the items "unfriendly and dislike" (p.397).	
Physical Aggression	"Hurting or harming others physically representing the instrumental or motor component of behavior."(p. 457)	Buss and Perry (1992).
Verbal Aggression	"Hurting or harming others verbally representing the instrumental or motor component of behavior" (p. 457)	
Anger	"Physiological arousal and preparation for aggression representing the emotional or affective component of behavior" (p. 457)	
Hostility	"Feelings of ill will and injustice representing the cognitive component of behavior" (p. 457)	