A Study of Digital Game Addiction from Aggression, Loneliness and Depression Perspectives

Eui Jun Jeong
Dept. of Digital Culture &
Contents, Konkuk University
stevejeong@gmail.com

Dan J. Kim
IT & Decision Sciences,
Univ. of North Texas
Dan.kim@unt.edu

Dong Min Lee & Hye Rim Lee
Dept. of Digital Culture &
Contents, Konkuk University
dleesky@gmail.com/
nevercry21@naver.com

Abstract

Previous studies showed the effects of psychological variables such as depression and loneliness on game addiction. Likewise, the effect of aggression on game addiction has also been reported. However, little research has empirically proved the role of aggression between the psychological variables and game addiction. In addition, in the context of game addiction, few studies have investigated their relationships in an integrated model using sub-factors of each construct. With survey data of 789 subjects, focused on the psychosocial variables (e.g., aggression, depression, and loneliness), the current study analyzed a path model to examine 1) the effects of loneliness and depression on aggression, 2) the psychosocial variables' effect on game addiction, and 3) mediation role of aggression between psychological variables (e.g., depression and loneliness) and game addiction. Results showed the important roles of aggression in the model. Aggression was significantly affected by both loneliness and depression, and in turn, aggression was the strongest determinant on game addiction among the three variables. Notably, aggression played a mediation role between depression and game addiction. Results and implications were discussed.

1. Introduction

Digital games tend to attract increasing amount of time, money and energy from players, which in turn, may accompany negative life outcomes. Accordingly, there have been a variety of perspectives and approaches for access to digital game addiction. For instance, there have been fruitful studies focused on various factors (e.g., motivations for playing, personality-traits, structural characteristics of game, cultural and social factors, etc.) that may predispose people to develop game addiction [1]. Among them, related to psychosocial health, exploring the association between psychosocial factors (i.e., loneliness, depression, and aggression) and game addiction has recently attracted the attention of scholars. However, although there is a growing body of evidence that supports the relationship, it is still in its early stage [2].

Recently, digital game addiction has become a social issue related to public health. Many of previous studies reported that game addicts are difficult to manage their daily life with psychological and social problems [1, 3, 4]. Such problems seem much serious for young game users, which has drawn attention of policy makers [5, 6]. In Korea, for example, it has been over two years since the government administered the shutdown law that prohibits players under sixteen from online gaming between midnight and 6 in the morning. Recent research, however, has reported little effect of the law in alleviating digital game addiction [7]. The researchers could not find any substantive change in the adolescents' gaming time before and after the enforcement of the law.

This result suggests two main things to be considered. Directly, from the perspective of policy makers, it is needed to seek a new or different approach rather than stimulating compulsory regulation in dealing with the game addiction issues. Fundamentally, regarding to determinants of game addiction, the result takes us to the recent issue that how game addiction is associated with the users' psychosocial factors. Exploring the relationship between game addiction and psychosocial variables could be essential to identify individuals who may be susceptible to the addiction. Moreover, it could practically suggest a new and comprehensive direction for policy makers.

Previous researchers have suggested that psychosocial factors may induce individuals to be addicted to online games [8-13]. However, although there have been a number of studies that empirically showed the effects of psychological variables (i.e., depression and loneliness) on aggression [14-21], little research has explored the association among the three variables (i.e., depression, loneliness, and aggression) and their effects on game addiction. In addition, the effects of psychosocial factors on game addiction have not been examined as an integrated model to date as

well, while each construct has been tested separately in prior studies with other personal characteristics [8-13, 22-25] In particular, as far as we can tell, prior studies in gaming addiction have not considered the sub-traits of such factors in detail.

In light of these issues, we aim to explore the relationships between game addiction and psychosocial factors in a path model. More specifically, we examine the effects of psychological variables on aggression, the effects of psychosocial factors on game addiction, and the mediation role of aggression between psychological variables and game addiction. Notably, this study tests an integrated model which includes sub-dimensions of each construct. With these considerations, it may offer insights into clinical interventions and effective policies.

2. Literature Review

Game addiction generally refers to an excessive or compulsive use of computer game that results in negative consequences and unhealthy behaviors in daily life [26]. Game addiction is also called "problematic game use" [13, 27], "problematic gaming" [28], "pathological video gaming"[9, 29, 30] "Internet gaming addiction"[1], "Internet gaming disorder"[6], including "gaming addiction" [31, 32].

Recently, American Psychiatric Association (APA) has encouraged further research to determine whether game addiction should be considered as a pathological disorder [6]. To date, game addiction, or IGD (Internet Gaming Disorder), was included in section III of the DSM-5 (5th version of the Diagnostic and Statistical Manual of Mental Disorders, May 2013) as a condition for additional study [6].

From a phenomenological perspective, game addiction is mainly associated with amount of time or money spent on game, insufficient sleep, and lack of interpersonal relationships [33]. Wan and Chiou [34] found that online game addicts regarded gaming as a substitute to fulfill their needs, which were not satisfied in their real lives. In this way, gaming becomes deeply involved in their lives and in turn, brings about negative life outcomes such as psychological problems, physical problems, and professional/academic problems [1, 3, 4].

Considering those outcomes in life, game scholars have regarded game addiction as a multidimensional concept. Griffiths [35], for example, employed some criteria symptoms such as salience (i.e., dominated by the games), conflict (i.e., conflict with others), and withdrawal (i.e., unpleasant emotion or physical problem from cessation of games). Likewise, based on behavioral addiction, Young [36, 37] created the Internet Addiction Test (IAT) scale which estimates

the degree of Internet game addiction by summing up such factors of the symptoms. Widyanto and McMurran [38] adopted such factors as primary sub-dimensions of the addiction and indicated a six-factor structure with salience, excess use, neglecting work, anticipation, lack of self-control, and neglecting social life. Liu and Peng [4], from the perspective of cognitive disorder, included some cognitive and behavioral effects such as lack of control, neglect work, and social problems.

Despite the fact that excessive engagement with (both online and offline) digital games appears to lead to addiction, there is a general agreement that online gaming, especially massively multiplayer online role-playing games (MMORPGs), may be more problematic for at-risk individuals than offline gaming [39-42]. This is because involvement in MMORPGs demands great time investment [43-45] and potentially result in negative outcomes in daily life [46, 47] for certain individuals[2]. In addition, MMORPGs are appealing to a wide range of players because they are highly interactive, social and competitive and are dealing with fantasy providing real life simulation and role-play with interactive real-time services [2, 44, 48-55]. Allowing individuals to play various characters they choose within a phantasmal world makes players feel free from social anxiety [10].

According to Yee [56] who conducted online survey to investigate the gaming motivations, the reasons why individuals are engaged in MMORPGs can be subsumed under the key aspects of accomplishment in the game, social activities and immersive virtual environment. The author also found that the gaming motivations such as escapism and achievement in the game appeared as significant predictors of problematic gaming [56].

Instead of the term, "addiction", LaRose, Lin, and Eastin [57] suggested that the term, *deficient self-regulation* may be appropriate to describe habitual Internet (game) usage based on the finding that the number of people who are truly addicted 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 [1] empathized that the term, "addiction," must be applied only when significant negative consequences of excessive gaming arise since game addiction researchers used the terms 'addiction' and 'compulsive use' interchangeably.

From this perspective, some scholars have struggled to provide a standard set of criteria for distinguishing addiction from high engagement. For instance, grounded on Brown's components model of addiction [58, 59], Charlton and Danforth [53] found that

cognitive salience, euphoria, and tolerance are peripheral symptoms, whereas conflict, relapse, (behavioral) salience, and withdrawal are core criteria in defining game addiction. They identified that peripheral symptoms are constructs that appeared in both a high engagement and pathological gaming [53]. 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 [4] found that withdrawal primarily represents the psychological condition of people with regards to MMOG dependency. Griffiths and Meredith [3] also provides a useful basis to differentiate excessive activity from addictive activity: They described that "Healthy excessive enthusiasms add to life, whereas addictions take away from it"[3].

3. Research Model Development

3.1. Depression and game addiction

Depression is one of significant psychological characteristics that are linked to online gaming dependency or problematic Internet use. According to The National Institute of Mental Health[60], depression involves signs and symptoms such as persistent sad, anxious, or empty feelings, feelings of hopelessness or pessimism, feelings of guilt, and so on.

A relationship between depression and game addiction has been established by many researchers [11-13, 25]. For instance, Peng and Liu [11] showed that depression is positively related to online gaming dependency. They employed a cognitive behavioral model of problematic Internet use [61] and Caplan's model [62] as a theoretical framework for this relationship.

The key traits of Davis's cognitive-behavioral model of problematic Internet use (PIU) are 'maladaptive cognitive pervasions' about the self and the world in online and offline space. Davis argues that lonely and depressed people may have devaluation about the self and the world while they may have positive views of the online self and the online world [61]. Davis's model explains that "a vicious cycle of cognitive distortions and reinforcement" causes behaviors that bring out problematic issues as a consequence of spending large amount of time online [61]. This model can be employed for not only general Internet use but also online gaming [4].

Based on Davis's theory, Caplan [62] argues that lonely and depressed individuals may have difficulty in forming and maintaining social relationships when they are situated in 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 face-to-face social activity [62]. Therefore, lonely and depressed people may perceive Internet use as a refuge to relieve their negative feelings. In sum, psychosocially distressed people have a preference for online social interaction due to negative perceptions of their social competence which, in turn, leads to excessive and compulsive Internet use that result in negative life consequences.

Mentzoni and colleagues [12] also found the association between problematic use of video games and high levels of depression. Similarly, Wenzel and her colleagues [25] identified positive links between frequent uses of video games and depression, self-reported sleep problems, suicidal ideation, anxiety, obsessions, and compulsions.

Seay and Kraut [13] and LaRose, Lin, and Eastin [57] demonstrated that depression or media habits formed to escape from blue moods diminish the effects of self-regulation. The deficient self-regulation develops problematic use of online gaming or media behavior on the basis of frameworks originated from Bandura's social cognitive theory of personality [63]. According to Bandura's social cognitive theory, depression may weaken self-regulation because depressed individuals tend to devaluate their ability. Overall, these findings from prior studies suggest that depression may be positively associated with game addiction.

3.2. Loneliness, aggression, and game addiction

Loneliness can be defined as the unhappy and disturbing sentiment due to absence of a companionship [64]. In general, it is assumed that loneliness is related to social isolation. However, people can be lonely even when they are surrounded by other people. Accordingly, qualitative aspects of social relationships may be more closely connected to loneliness than quantitative ones [64-67].

Previous research has demonstrated that loneliness is positively associated with pathological gaming. A cross-sectional study conducted by Kim and his colleagues [22] indicated that a reciprocal relation between pathological gaming and loneliness among adolescents based on Davis's cognitive-behavioral model of PIU [61] and Bandura's social cognitive theory of personality [63]. Consistent with prior work, a study by Lemmens and his colleagues [9] reported that loneliness and low social competence are significant predictors to pathological gaming. Moreover, they found that loneliness was also a key determinant to pathological gaming [9].

The underlying idea of these studies is that people who suffer from psychological problems (e.g.

loneliness) may use online or video games as a way to satisfy their needs, which cannot be fulfilled in real life, so that they escape from negative moods. Consequently, emotionally susceptible individuals may be deeply immersed in a virtual life.

Besides depression and loneliness, *aggression* is one of the most discussed psychological variables that are associated with gaming addiction. According to Anderson and Bushman [68], "Human aggression is any behavior directed toward another individual that is carried out with the proximate (immediate) intent to cause harm" [68]. They argue that the assaulter should certainly aware that the target will be damaged by his or her behavior, and that the target is actuated to avoid the action [68-72].

Previous research has displayed an association between aggression and online game addiction. For instance, Kim and his colleagues [8] found that the trait of aggression is associated with higher online game addiction score based on a framework cited from trait theory [8-10, 24]. In addition, another research shows a significant link between online gaming addiction and aggressive trait suggesting that aggressive behavior may play a role in fostering the development of online gaming addiction [10].

Likewise, a number of studies have reported the association between the preference for violent game and excessive game use [5, 73-76]. Lemmens, Valkenburg and Peter [9] have reported that excessive adolescent male players prefer to play violent video games. Similarly, Griffiths [24] have indicated that aggressive children are attracted to violent games.

The underlying mechanism for this relationship is premised on the assumption that prior aggression leads to excessive use of 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 like aggression, which means searching for particular type of game is regarded as "active process, not passive one" [77]. 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 [10]. In this process, aggressive behaviors may become "goal-directed"[10].

3.3. Depression and loneliness as risk factors for aggression

Many studies have claimed that lonely or depressed individuals have aggressive tendencies. Much research has linked loneliness to general hostility [18]; to anger-hostility [19]; and aggressive behavior [20][27] (e.g., verbally expressed hostility towards woman [21].

Based on the social skills perspective [78], Check, Perlman and Malamuth [21] explained how the link between loneliness and hostility is formed. According to Jones, Freemon, and Goswick [79], lonely individuals are deficient in social skills with a biased view of their perception and judgment on their performance in social interactions [21, 79]. For this reason, lonely people tend to have little interest in others [78, 80] and potential social relationships [21]. This may result in "rejection and subsequent social isolation" that may trigger "extreme and negative reactions to such rejection" [21].

In a similar vein, a psychodynamic formulation for depression has indicated its association with aggression. According to Busch [16], people inclined to feel blues might be sensitive and vulnerable to loss or social rejection [16, 81, 82]. This sensitivity develops with an individual's experience "feelings of sadness and unlovability, disappointment and helplessness, and rejection" in their early days and in turn, these negative experiences often provoke angry reactions to people [16]. This anger towards others often induces guilty feelings and become directed to the self, which, in turn drops self-esteem completing "a vicious cycles in depression" [16]. Morrow and his colleagues [83] 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 [17]. For instance, Roland [14] distinguished reactive and proactive aggressiveness and found a significant relationship between self-reported depressive symptoms and proactive aggressiveness. The author thinks of proactive aggressiveness as a motivator that triggers bullying behavior. In another study, Ji and Jang [15] provide an evidence that depression is a significant contributor to aggression for the elementary students. They considered children's aggressive behavior as a feature of depression and viewed depression as a form of aggression toward the self [15].

In a similar vein, Busch [16] concluded that the anger is a salient trait of depression through investigation of several studies that generally indicated the close link between anger and depression. In addition, Ko, Yen, Liu, Huang, and Yen [76] considered depression as one of shared associated factors for predicting the aggression for young adolescents in their study that evaluates the association between Internet addiction and aggressive behaviors. Likewise, Dutton and Karakanta [17] argue that depression should be considered as a risk indicator for aggression based on the critical review towards previous empirical studies. Dodge and Coie [84] also found an association

between depression and the hostile-impulsive-uncontrolled kind of aggression..

3.4. Research model

Previous studies suggest that psychological traits such as depression and loneliness could be considered as antecedent variables of game addiction [9, 11-13, 22, 25]. Depressed or lonely individuals may have lack of social skills and low social competence in real life [62]. Therefore, they are likely to prefer computer-medicated communication [62]. In addition, they tend to have maladaptive cognitive distortions about themselves and the world or their ability in both online and offline [61]. As such, they are likely to feel more confident with online environment [62].

Overall, individuals with depression or loneliness may prefer computer-mediated environments (e.g., virtual life in computer game [4]) rather than face-to-face contact as a way to fulfill their needs that cannot be met in real world. Therefore, the following hypotheses are explored:

H1: When an individual has a higher degree of loneliness, he or she will show a higher degree of game addiction.

H3: When an individual has a higher degree of depression, he or she will a higher degree of game addiction.

In company with depression and loneliness, individuals with aggression tend to use video games excessively. According to previous studies [8-10, 24], aggression is regarded as one of significant predictors of problematic gaming. For aggressive people, aggressive tendency to be easily neurotic and aroused could make them feel difficulty in interacting with others [85, 86]. With such lack of social interaction, they may become indulged in playing online games as a means to solve their problem [34].

Furthermore, people who tend to be aggressive may search certain types of games such as shooting or action that satisfy their disposition [9, 24]. Previous research has reported that the preference for violent games is positively associated with excessive game use [5, 10, 73-76]. As players receive rewards for their aggressive behavior, game violence is more likely to be repeated for an accomplishment in the game [10]. In this way, game players may be deeply immersed in game play. In particular, considering that most game players in South Korea enjoy online social games such as MMORPGs, shooting, fighting, and adventure games where players should shoot monsters for item-collection or kill opponents for the accomplishment of higher levels [87], user aggression could be one of primary antecedents to game addiction. Thus, we propose the following hypothesis:

H2: When an individual has a higher degree of aggression, he or she will show a higher degree of game addiction.

Finally, as has been noted above, depression and loneliness are closely associated with aggression and are considered as an influential predictor for aggression [17-21]. Previous research found that depressed 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 lack of social skills [16] or little interest in others [78, 80] and they are likely to be vulnerable to such social situation [16]. Therefore, these accumulated experiences may trigger anger or hostility toward others or the self [16, 21]. Actually, for children and young adolescents, aggression can be considered as a consecutive aspect of depression [15]. Grounded on these findings, we developed the following hypotheses.

H4: The degree of loneliness is positively associated with the degree of aggression.

H5: The degree of depression is positively associated with the degree of aggression.

Consequently, psychological factors such as depression, loneliness, and aggression may entail problematic game use. Moreover, depression and loneliness could be considered as risk factors for aggression as prior studies revealed that aggression is linked to both depression and loneliness.

4. Methodology

4.1. Data collection

A total of 789 participations in Seoul, the capital of South Korea, were surveyed. The survey was conducted by a professional survey institute with the population list. Among the participants, 395 (50.1%) of the participants were males, and aged from 16 to 59 (M = 38.8, SD = 11.9). As a reward, all participants received 5,000 KRW (about 5 USD) for their involvement in the survey. All the participants had ever played online or mobile games. Among the participants, 83.9% of them had played online network games including MMORPGs (e.g. Lineage, LOL, etc.), Strategy games (e.g., StarCraft) shooting (e.g., CounterStrike, Call of Duty, etc.), and action (e.g., Virtual Fighters) games.

The questionnaire included the Game Addiction Scale, the Buss-Perry Aggression Questionnaire, the UCLA loneliness scale, and the short form of the Center for Epidemiological Studies Depression scale (CESD) with demographic questions such as age, sex, and occupation.

4.2. Measurement instrument

As recommended by Bentler and Chou [88], each construct was measured by at least three observable indicators. Multiple measures for each construct provided more accurate representation of the concept of construct. The items were written in the form of statements or questions by following the suggestions of Tourangeau, Rips and Rasinski [89]. Most measurement items were borrowed from existing studies and adapted to the study context. All items were based on five-point Likert scales anchored at Strongly Disagree (1) to Strongly Agree (5).

Game addiction. Game Addiction was measured with a modified version of Young's Internet Addiction Test (IAT) [37] 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 intended, I snap, yell, or act annoyed if someone bothers me while I play games). The revised version has also been used in previous studies [26]. Pertaining to sub-factors, Widyanto and McMurran [38] indicated a six-factor structure with good internal consistency. The six factors involve salience, excess use, neglecting work, anticipation, lack of self-control, and neglecting social life. Each construct shows high reliability.

Aggression. Aggression was measured with 29 items from the aggression questionnaire by Buss and Perry [90]. With respect to sub-traits of aggression, four components are yielded from factor analysis. They have identified that aggression consists of four scales: physical aggression; verbal aggression; anger; and hostility.

Constructs		# of measures	Mean (S.D.)*	Cronbach Alpha	CR	AVE
Game Addiction	1. Salience	5	2.464 (.800)	0.845	0.891	0.625
	2. Excessive use	5	2.351 (.861)	0.873	0.908	0.663
	3. Neglect work	3	2.080 (.917)	0.859	0.914	0.779
	4. Anticipation	2	2.342 (.873)	0.648	0.850	0.739
	5. Lack of control	3	2.282 (.904)	0.812	0.889	0.727
	6. Neglect social life	2	2.026 (.867)	0.775	0.899	0.816
Loneliness	7. Positive Loneliness (R)	9	3.020 (.491)	0.900	0.919	0.559
	8. Negative Loneliness	13	2.306 (.531)	0.914	0.929	0.566
Aggression	9. Anger	7	2.749 (.586)	0.865	0.903	0.654
	10. Hostility	8	2.756 (.629)	0.844	0.880	0.480
	11. Physical Aggression	9	2.403 (.619)	0.885	0.910	0.593
	12. Verbal Aggression	5	2.859 (.633)	0.766	0.845	0.584
Depression	13. Depressed Affect	3	1.540 (.705)	0.858	0.913	0.778
	14. Positive Affect (R)	2	2.929 (.864)	0.759	0.892	0.805
	15. Somatic & Retarded Activity	4	1.566 (.568)	0.705	0.819	0.536
	16. Interpersonal factor	2	1.347 (.622)	0.828	0.92	0.853

Figure 1. Reliability and Validity of Constructs

Loneliness. Twenty-item UCLA loneliness scale was used to access the level of loneliness. Examples of items involve "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?"[91]. With regards to the factors of the UCLA loneliness scale (Version 3), Knight and colleagues [92] and Miller and Cleary [93] verified two factors involving positive (non-lonely) and negative (lonely) items. Along with these two method factors, Russell [91] found that a bipolar global loneliness factor provides a satisfactory fit to their data through confirmatory factor-analytic procedures. In this article, we adopted this analysis.

Depression. Eleven items were used to access the level of depression. CESD-11 is a short form of the Center for Epidemiological Studies Depression scales. According to Radloff [94], depression can be explained from four aspects: depressed affect (blues, depressed, lonely, cry sad); positive affect (good, hopeful, happy, enjoy); somatic and retarded activity (bothered, appetite, effort, sleep, get going); interpersonal (unfriendly, dislike).

4.3. Data analysis and results

To validate the proposed research model, we use the component-based structural equation modeling-Partial Least Squares (PLS) technique. Following the two-step approach, we examine the reliability and validity of the measurement model first and then the structural model next to test the proposed research hypotheses.

The results showed that loneliness (b=.291, p<.01) and depression (b=.426, p<.01) had significant effects on aggression, in support of H4 and H5. In turn, aggression had a substantial effect on game addiction (b=.421, p<.01), supporting H2. Interestingly, contrary to our expectation, the effect of depression on game addiction (b=.098, p>.05) was insignificant while that of loneliness was significant (b= .164, p<.05); H3 was not supported but H1 was supported respectively.
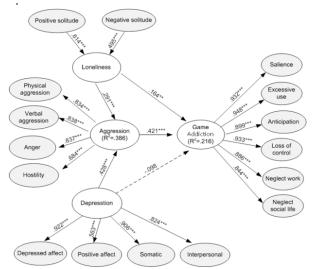

Figure 2. Research Model and Hypothesis

Considering the insignificant effect of depression on game addiction, the indirect effect of depression on game addiction via aggression (i.e., mediation effect of aggression) is tested. Following the Sobel test [95], a common approach to test mediating effect, we test the mediating effect of aggression on game addiction. When testing mediating effects, we should examine the relationship between depression and game addiction compared with the relationship between depression and game addiction including the mediator (i.e., aggression). According to Baron and Kenny [96], four conditions should be satisfied in order to conclude the mediation effect in the model: 1) independent variable must significantly affect dependent variable without including the mediator; 2) independent variable should affect the mediator significantly; 3) the mediator must affect the dependent variable significantly; and 4) the relationship between independent and dependent variable should be non-significant when the mediator is included

The direct effect of depression should be significant if the mediator is not included in the model. Thus, we ran the model without depression and the result showed that the path coefficient of depression on game addiction is 0.2487 ($p < 0.001$). When including aggression, the mediator, the path coefficient of depression on aggression is 0.5835 ($p < 0.001$) and the path coefficient of aggression on game addiction is 0.4836 ($p < 0.001$). Interestingly, with the mediator in the model, the path coefficient of depression on game addiction turns to -0.0525 ($p > 0.05$) which is non-significant. The Sobel test t-statistic is 6.9048 ($p < 0.001$). Therefore, we can conclude that mediator (i.e. aggression) is fully mediated the relationship between depression and game addiction.

Considering sub-factors of depression, we also examined each sub-factor's effect on game addiction. The result showed that, among the sub-factors of depression, only interpersonal factor exhibited a significant effect on game addiction (b=.170, p<.05). The three other factors (i.e., depressed affect, positive affect, and somatic) did not show any significant effect on game addiction.

5. Discussion

5.1. Findings and Implications

Focusing on psychosocial variables, this study investigated the associations among loneliness, depression, aggression, and game addiction by considering sub-factors of each construct. We analyzed an integrated model in order to test the effects of loneliness and depression on aggression, and to see the overall effects of the psychosocial variables on game addiction.

The first finding in the current study is that aggression did a crucial role in predicting the degree of game addiction. Previous studies have focused on either depression or loneliness in explaining determinants of game addiction [9, 11]. However, aggression has not been highlighted in game addiction studies, even though 7 out of 10 hit games are violent games in the global game markets in 2015 [97]. In the results of this study, aggression was the strongest determinant on game addiction among the psychosocial variables. People who are aggressive express their aggression through diverse channels. Online games can be one of the means to reveal their aggression because online games contain some aggressive factors. In particular, many multi-user online games provide PK (Player Killing) system with which one user can kill any of other users to take items or just for fun [98]. In addition, violent environments in which users should kill the opponents for survival and rewards such as valuable items or scores also stimulate aggressive users to be engaged in the games [10].

In line with that, aggressive people are inclined to be immersed in playing online games. It could be because aggression prevents them from interacting with others. It implies that aggression could cause them to disconnect with people, thus, people who are aggressive become socially isolated. As a result, the aggressive are more likely to be indulged in playing online game because they become to lack of social interaction and are in a status of social withdrawal [21, 83]. Thus, the aggressive could have a tendency to play online game 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 implicates the important role of user aggression with regard to game addiction. Additionally, the result is consistent with that of previous studies, which showed the significant effects of loneliness and depression on aggression [16, 17, 21]. Loneliness positively affected aggression. People who are lonely tend to be immature in social interaction because they lack of social skill and learning chances through experiences [62, 78, 99]. These could make them unconcern about others and be isolated from social relationship. Furthermore, exclusion and rejection from others and society make them be aggressive to others and society [21]. Likewise, depression also substantially affected aggression. Depressed people tend to be susceptible and vulnerable to control their emotion. In this sense, it is difficult for the depressed to handle their aggression to others or society when external stimuli arouses their anger [16]. The depressed are sensitive to external stimuli, thus,

they might 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 that of previous studies. When people are socially excluded or feel lonely, they used to search for channels to gratify their needs or to relieve their stress [34]. Access to online games is a relatively easy way to solve desire or release stress because online game is a channel close at hand. Thus, they can frequently contact to online games rather than interact with others. Especially, the more people are socially isolated, the easier they become an addict to play online game because connecting online games is even easier than contacting others. As Yee [56] reported, such escapism is a key motivation to be engaged in online games. Thus, the people who feel alone or are isolated from others tend to be absorbed in online games because they do not have a difficulty to gain emotional satisfaction from social interaction online, and because they can comfort their loneliness easily by playing online games.

Contrary to 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 them away from a mood of melancholy. However, the result showed 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 [62] reported the mediation role of "preference for online interaction" between depression and problematic Internet addiction.

Second, playing games could primarily satisfy people who became depressed from interpersonal (i.e., social) problems. Different from loneliness, depression seems to be associated with various factors such as social problems, stress from failure, disease or illness. However, it seems that depression induced by interpersonal problem may serve as a catalyst for seeking substitute for lack of relationships in reality [34]. This was also supported in this study by conducting post hoc analysis. Among the four sub-factors of depression, only the interpersonal factor showed a significant effect on game addiction. As previous studies explained [16, 21], 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 social exclusion in real life. To fulfill their social desire in actual life, they might be immersed in online games.

5.2. Contributions and limitations

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. The model also shows the important role of aggression between psychological variables and game addiction. Specifically, it exhibits the effects of loneliness and depression as determinants of game addiction. Previous models (e.g., Davis' model) mainly focused on psychological variables such as loneliness and depression. Such models paid little attention to the role of aggression toward game addiction. The current study provides clear results about the associations among the psychosocial variables and their effects on game addiction in the integrated model.

Next, this study considered sub-factors of each construct in the integrated model. Even though the main variables have been used in previous studies, 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 addition, regarding psychosocial antecedents to game addiction, considering sub-factors of each construct could provide much detailed results in the model. The current study examined the integrated model including sub-dimensions of each construct, and notably found only the interpersonal factor of depression affects the degree of game addiction.

Third, this study shows the mediating role of aggression between depression and game addiction. Previous studies reported the direct effect of depression on game addiction However, in the area of game addiction studies, little research tested the mediation role of aggression.

From a practical perspective, this study hints some effective policies for policy makers and social activists. The results mean that the psychosocial factors should be considered in order to prevent people from game addiction because the determinants directly or indirectly associated with game addiction. As the case of shutdown policy shows, compulsory regulation forbidding gaming is hardly effective for game addiction. Policy makers need to comprehensively concern the antecedents of game addiction when it is about to handle and cure game addiction problem. For example, government can establish and operate

aggression and loneliness management center in local neighborhood to treat and prevent game addiction.

This research tested the relationship between aggression and game addiction, and showed positive relationship between them. However, it can be argued that aggression is positively associated with game addiction by mediating social interaction. In this study, we only tested the effect of loneliness on aggression, not the impact of aggression on social interaction. In the future study, the relationship between aggression and social interaction and between social interaction and game addiction can be considered.

Another limitation is about sampling and causality. This study was conducted only in one country, South Korea. In the country, online games comprise more than 80% of the whole game markets as a leading culture. Such a particular environment could cause somewhat different aspects regarding game addiction. Future studies need to collect data from various countries for the generalization of the results. Likewise, one time survey is difficult to guarantee the causal relationships in the model. Future studies need to collect longitudinal or panel data.

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