

# Explaining the Development of the Excessive Use of Massively Multiplayer Online Games: A Positive-Negative Reinforcement Perspective

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## Abstract

*Despite a rising concern over this emerging global issue, theoretical understanding of the excessive use of massively multiplayer online games (MMOGs) is lacking in the mainstream IS literature. In this study, we proposed a research model to theoretically explain the development of the excessive use of MMOGs with the positive-negative reinforcement perspective. We tested our research model with 513 active users of MMOGs. Our results suggested that both positive reinforcement (i.e., perceived enjoyment and the associated positive affect) and negative reinforcement (i.e., withdrawal and the associated negative affect) have strong influence over the development of the excessive use of MMOGs. This study provided a theoretical explanation of the excessive use of MMOGs and implications to researchers and practitioners.*

**Keywords:** Excessive use, massively multiplayer online games, positive-negative reinforcement, affect, perceived enjoyment, withdrawal, addiction

## 1. Introduction

Addictive or excessive use of IS/IT has emerged as a national problem over the globe, and different governmental interventions have been introduced in order to combat this potential psychological and behavioral disorder [1]. Witnessing the growing concerns about the negative consequences brought by the excessive use of hedonic IS/IT, the line of research on the dark side of IS/IT use has been receiving increased attention among IS scholars.

The concepts of addiction have been explored and incorporated into hedonic IS/IT use studies across various contexts including online auction sites, social networking sites, and online games [2-4]. Specifically, because of the interactive, immersive and persistent nature, MMOGs are regarded as one of

the most addictive hedonic IS/IT, and are prone to the development of excessive use. For example, there were increasing reported cases related to the negative consequences of excessive online gaming, including crimes and even deaths [e.g., 5, 6]. In response to this phenomenon, researchers across disciplines have devoted enormous efforts in understanding the addictive or the excessive use of MMOGs [e.g., 7, 8]. Most of the existing studies are found in psychology and medical literature with a focus on examining diagnosis and treatment strategies. There are very limited number of theory-guided studies on the excessive use of MMOGs [e.g., 4, 9, 10], and thus, we have not identified any comprehensive theoretical framework explaining the development of the excessive use of MMOGs in the mainstream IS literature.

As a step towards bridging these gaps, the current research aims to propose and empirically test a theoretical model of the development of the excessive use of MMOGs with the positive-negative reinforcement perspective. We organize the rest of this paper as follows. In the first section, we present the theoretical background. Then, we discuss our research model of the development of the excessive use of MMOGs. After describing our research design, we present the results of our data analysis. Finally, we conclude with a discussion of the implications for theory and practice.

## 2. Theoretical Background

In this section, we describe the theoretical foundation of the current investigation. Specifically, we review prior studies on dark side of IS/IT, excessive use of MMOGs, the positive-negative reinforcement perspective, and discuss the role of perceived enjoyment in the development of the problematic use of IS/IT.

## 2.1. Dark Side of IS/IT Use

Traditional IS literature emphasizes on the benefits and values created through the use of IS/IT. Predominant frameworks in IS studies, such as the technology acceptance model (TAM) [11], unified theory of acceptance and use of technology (UTAUT) [12], and the IS continuance model [13], are basically associated with positive systems use. Probably as a consequence of this, dark side or negative use of IS/IT is not well-understood in the mainstream IS literature.

Studies on the excessive use of IS/IT are relatively new in the IS literature, and the scientific understanding of these issues is still evolving [3]. Young [14] was among the first to bring clinical attention to Internet addiction and raised a cautionary tale of the psychological harm of using the Internet. Since then, research on the excessive use of Internet-based technology has grown substantially. Studies on problematic or addictive use of IS/IT have been extended to various contexts of Internet-based technologies including both utilitarian and hedonic systems. For utilitarian system use, problematic use has been examined in the contexts of email, and work-related information communication technology (ICT) [15]. Problematic use of hedonic systems has been investigated across diversified hedonic contexts, including social networking sites [2, 16], mobile phone [17, 18], online auction [3], and online gambling [19].

Though a majority of studies on problematic use of IS/IT was found in the psychology and medical literature, the phenomenon has just received attention from IS researchers. Turel and his team [2-4, 15], pioneers in the study of the dark side of using IS/IT, have explored the concepts of addiction in various technologies, including online auction sites, mobile email, social networking sites, and online games.

## 2.2. Excessive use of MMOGs

MMOGs have emerged as one of the most potentially addictive hedonic IS/IT. In response to calls for research on the excessive use of potentially addictive online activities and Internet-based applications, an increasing number of studies have been conducted to investigate the excessive use of MMOGs [e.g., 4, 7, 20, 21]. We have conducted a comprehensive review of prior studies on the excessive use of MMOGs, and the results showed that previous studies mainly focused on risk factors leading to the excessive use of MMOGs [e.g., 7, 8]. There is a significant number of studies examining

diagnoses and treatment strategies of the excessive use of MMOGs [e.g., 22, 23]. There are, however, very limited number of theory-guided studies on the excessive use of MMOGs [e.g., 4, 9, 10]. Furthermore, there is a lack of a comprehensive theoretical framework explaining the development of the excessive use of MMOGs.

## 2.3. Positive-Negative Reinforcement

Positive-negative reinforcement has gone by many different names, including opponent process, hedonic homeostasis, hedonic dysregulation, and reward allostasis [24]. This perspective has been found useful in understanding various human behaviors across diversified areas of psychological research, including addiction, children attachments, love and affection, thrill-seeking behaviors, the dynamics of fear and avoidances, depression and euphoria, and obesity to mention a few [25]. Particularly, the positive-negative reinforcement perspective is believed to offer the most intuitive explanation of addictions [26].

The pleasure-withdrawal view of addiction from opponent process theory of Solomon and colleagues [24, 25, 27] has been regarded as the most elegant psychological version of the positive-negative reinforcement [26]. Opponent process theory describes the underlying positive and negative reinforcement, and makes testable prediction of addiction [28]. The positive-negative reinforcement pertains to certain features: (1) process-a (process activated by the pleasure-generating event or substance); (2) process-b (process triggered by process-a as an opponent); and (3) the conditioning of state-A and state-B (subjectively experienced state from the summation of process-a and process-b) [24, 25, 27]. Applying this perspective in the context of hedonic IS/IT such as MMOGs, we posit that playing MMOGs activates process-a (pleasant in nature), and the associated positively affective state, which in turn triggers the activation of process-b (unpleasant in nature), and the associated negatively affective state as opponent [26]. Typically, process-b helps to restore the homeostasis and regulate brain states back to normal. The summation of process-a and process-b results in the final subjectively experienced state felt by the individual. The resulting experienced state is referred to state-A when the summed effect is positive (i.e., process-a > process-b), or state-B when the summed effect is negative (i.e., process-a < process-b) [26]. To maintain the positive affective state (state-A), or to reduce the negative affective state (state-B), one has to repeat the pleasure-activating event (e.g., go on playing MMOGs).

Through the positive-negative reinforcement, certain behaviors are thus reinforced and encouraged in a continuous basis, which in turn increase the likelihood of leading to excessive behaviors.

The positive-negative reinforcement perspective has been widely adopted to explain various substance addictions, including heroin, opiate, barbiturate, amphetamine, alcohol, and nicotine [29, 30]. This perspective has considerable explanatory power that goes well beyond explanation of substance addictions, and has been extended and developed to account for complex temporal variations in the rewarding events [29]. Specifically, this perspective has been adopted to explain a number of technology addictions, including pathological Internet use [31], Internet gambling addiction [32], and video gaming addiction [33]. In the similar vein, the positive-negative reinforcement perspective is believed to be highly compatible in elucidating the development of the excessive use of MMOGs.

#### 2.4. Enjoyment of IS/IT Use

Information systems or technologies are traditionally viewed as utilitarian tools for enhancing user's productivity, performance, or effectiveness in their personal lives or in the workplaces [2, 34]. With the recent breakthroughs and advancements in broadband infrastructure, interactive software and technologies, the scopes and applications of IS/IT have expanded beyond its originally utilitarian objectives to encompass also non-utilitarian objectives (e.g., hedonic uses) [34].

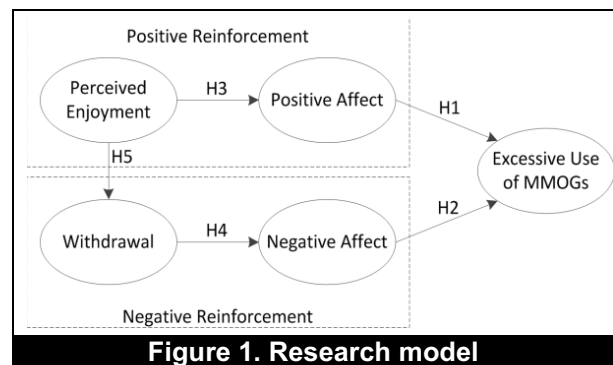
Perceived usefulness and perceived ease of use are two widely studied cognitions in examining utilitarian use of IS/IT [12]. These cognitions are regarded, however, relatively less salient in explaining the hedonic use of IS/IT; perceived enjoyment is believed to be a more appropriate alternative in the context of hedonic IS/IT [34]. Perceived enjoyment, alternatively termed as perceived playfulness, refers to the excitement and happiness derived from (hedonic) IS/IT use [35]. Hedonic IS/IT intends to maximize user's pleasure or enjoyment derived from the use. Perceived enjoyment has demonstrated a strong effect on user's attitude towards hedonic systems use [36]. Conversely, if hedonic systems use is perceived as being low in enjoyment or playfulness, users are less likely to experience the positive psychological state or develop positive attitude towards their usage.

Given its prevalence and importance, perceived enjoyment has been receiving increased attention from scholars in examining IS/IT use [e.g., 2, 34, 37]. Though perceived enjoyment is generally

hypothesized as a positive factor motivating, directly and indirectly, the use of IS/IT; it is plausible that in certain circumstances enjoyment would lead to undesirable IS/IT using behaviors (e.g., addiction) [2]. Accordingly, in this paper, we argue with the positive-negative reinforcement perspective that perceived enjoyment derived from playing MMOGs activates process-a, which in turn triggers the activation of process-b, and finally results in summated affect states (e.g., positive affect state or negative affect state). In order to maintain the positive affect state or to reduce the negative affect state, users have to increase and repeat their MMOGs use, which in turn set the stage for the excessive use of MMOGs.

### 3. Research Model and Hypotheses Development

Figure 1 depicts our research model. We built on the positive-negative reinforcement perspective to explain the development of the excessive use of MMOGs. Prior literature on problematic use of MMOGs has adopted various terminologies when referring to the phenomenon, that "excessive use" has been used interchangeably with the terms "addiction", "problematic use" and "dependence". In this study, we adopt the term "excessive use" to avoid theoretical overtone and to make it a starting point of the wide spectrum of problematic use of IS/IT. Following the prior literature [e.g., 38, 39], we define the excessive use of MMOGs as the use of MMOGs that involves the spending of considerable amounts of time, and during which users typically lose track and control of time.



The positive-negative reinforcement perspective offers an intuitive explanation of addiction that positive affective state is initially activated by pleasant-in-nature event. However, with the repetition of the event, homeostatic neuroadaptations lead to tolerance and dependence, such that

unpleasant withdrawal symptoms exist upon the cessation of the event, and result in negative affective state [26]. Continuous and repeated pleasure-generating events thus need to be performed to maintain the positive state or to avoid the negative state. The literature demonstrates that the positive-negative reinforcement perspective and the associated affective states are critical in explaining the excessive use behaviors and addiction.

In line with incentive theories of addiction, rewarding stimuli and events evoke a significant increase in zygomatic activity, indicative of positive affect and its contribution to the development of addiction through positive reinforcement [40]. Positive reinforcement has been hypothesized as one of the most significant perspectives explaining Internet addiction, as various Internet-based technologies support unpredictable reward structures [41]. Applying the concept to the context of MMOGs, users derive fun and enjoyment during game plays by accomplishing achievement, socializing, and immersing in the fantasy of the virtual world [42]. To maintain the positive affect resulted from the positive reinforcement, users are encouraged to play continuously and repeatedly, and which may in turn set the stage for the excessive use. Therefore, we have the following hypothesis:

*H1: Positive affect will be positively associated with the excessive use of MMOGs.*

Negative reinforcement has been extensively examined in the substance addiction literature, in that addicts are motivated to take drugs to avoid the unpleasant state [28]. The removal of the addictive substance or activity would trigger a heightened state of psychological and physiological arousal and discomfort [41]. Negative reinforcement has also been examined to explain deviant behaviors that individual performs impulsive act to escape from negative psychological state or to elevate negative mood [43]. Particularly, evidence from prior literature on problematic use of IS/IT coincidentally indicated that users would feel ill and obsessive easily when they are separated from the technologies (e.g., social networking sites) [1, 44]. In the current study, we expect that the unpleasant feeling or negative affective state will increase the likelihood of the excessive use of MMOGs. Therefore, we hypothesize that:

*H2: Negative affect will be positively associated with the excessive use of MMOGs.*

Behaviors that give people pleasant feeling or relieve their discomfort motivate them to repeat. According to the addiction literature [45], the perceived benefit of a particular activity appears to produce a positive affective state (e.g., through positive reinforcement), and increases the likelihood to repeat certain behaviors. Over time, users learn about the enjoyment of playing MMOGs, and that the enjoyment becomes cues activating the positive reinforcement and resulting in positive affective state. Though enjoyment is generally hypothesized as a positive factor motivating the use of IS/IT, directly and indirectly, it is plausible that in certain circumstances enjoyment leads to addiction [2].

On the other hand, reinforcement can also take the form of removal of an unpleasant stimulus (e.g., through negative reinforcement), and encourage an individual to continue an activity [26, 27]. For instance, a withdrawal symptom (e.g., the unpleasant feeling that occurs when online gaming is discontinued or suddenly reduced) gives rise to negative affective state and increases the chance the users repeatedly engage in MMOGs.

According to the pleasure-withdrawal view from opponent process theory, positive reinforcement and negative reinforcement processes are closely related to each other. That is, greater enjoyment derived from MMOGs use would result in greater degree of withdrawal when the use is discontinued or reduced [24, 25, 27]. Taken together, we have the following hypotheses:

*H3: Perceived enjoyment will be positively associated with positive affect in MMOGs use.*

*H4: Withdrawal will be positively associated with negative affect in MMOGs use.*

*H5: Perceived enjoyment will be positively associated with withdrawal in MMOGs use.*

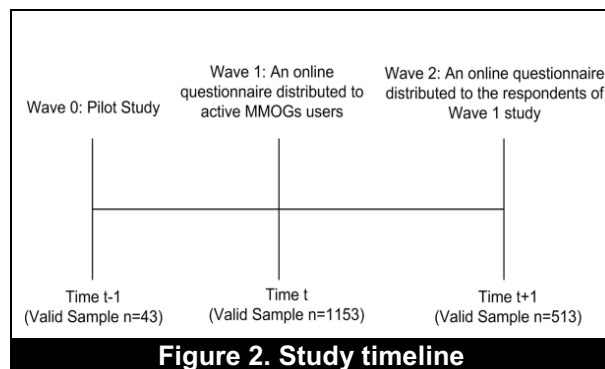
## **4. Research Methodology**

### **4.1. Sample and Data Collection**

In this study, we examine the development of the excessive use of a popular hedonic IS/IT, namely massively multiplayer online games. Our research model was assessed in a longitudinal design (see Figure 2). The use of a longitudinal design has been identified as an effective method to reduce common method bias [46] and to draw causal inference [47]. In order to improve the response rate and sample quality, we employed an online market research firm for data collection. MMOGs users were invited to complete an online questionnaire at two different

points of time. An online survey method is the most commonly used data collection method in prior studies on the problematic use of Internet-based technologies [48].

At time  $t-1$ , we conducted a pilot study with 43 MMOGs users to refine the clarity of instructions and questions in the online questionnaire. At time  $t$ , we collected responses related to reinforcement processes (e.g., positive and negative affect, perceived enjoyment, and withdrawal), and received 1153 completed and valid responses. Respondents from Wave 1 study were invited to answer another online questionnaire at time  $t+1$ , and responded to the dependent variable, the excessive use of MMOGs. 513 completed and valid responses were obtained for subsequent analyses.



**Figure 2. Study timeline**

## 4.2. Measures

The constructs of interest to this study were perceived enjoyment, withdrawal, positive affect, negative affect, and the excessive use of MMOGs. We used established measures from the literature (see Appendix A). All constructs were assessed using multi-item perceptual scales with responses measured on a 7-point Likert scale, ranging from strongly disagree (1) to strongly agree (7). Several items were used to assess each construct to ensure construct validity and reliability.

## 4.3. Sample Profile

A total of 513 useful online questionnaires across the two-wave study were collected. Among the 513 respondents, 53% were male and 47% were female. A majority of the respondents (42%) aged 26-30, followed by 35% aged 31-40. Respondents on average spent 4.7 days and 16.4 hours per week playing MMOGs respectively. Respondents had on average 4-year experience playing MMOGs.

## 5. Data Analysis and Results

The current study investigated the excessive use of MMOGs with a self-reported survey, in which socially desirable response was of the special concern. Therefore, the impact of social desirability bias was assessed by examining the Spearman correlation between the excessive use of MMOGs construct and social desirability bias (SDB) score [3]. The Spearman correlation between the excessive use of MMOGs and SDB was calculated, with  $\rho_{\text{excessive use of MMOGs-SDB}} = -0.12, p < 0.01$ . The mild correlation was expected, and this was much smaller than the correlation between SDB and compulsive buying scores as reported by Ridgway et al. [49] ( $-0.21, p < 0.01$ ), and was comparative to correlation between SDB and technology addiction score as reported by Turel et al. [3] ( $-0.12, p < 0.05$ ). It was concluded that while the social desirability bias exists, it was not a major issue in the current study.

Data analysis was performed in a holistic manner using partial least squares (PLS) method. PLS possesses the ability in modeling latent constructs under condition of non-normality and manipulate small to medium size samples well. PLS is also highly compatible in analyzing highly complex predictive models, and provided data for validating and interpreting the measurement model and structural model [50-52].

## 5.1. Measurement Model

The convergent validity and discriminant validity of the constructs in our model were examined. Convergent validity indicates the degree to which the items of a scale that are theoretically related are also related in reality. It was examined by the use of composite reliability (CR) and average variance extracted (AVE). The critical values for CR and AVE are at least 0.70 and 0.50 respectively [53]. As shown in Table 1, all CR and AVE values fulfilled the recommended levels, with CR ranging from 0.88 to 0.94 and the AVE ranging from 0.61 to 0.85. The results suggested an adequate convergent validity of all measurements.

Discriminant validity is the degree to which the measurement is not a reflection of some other variables. It is indicated by low correlations between the measure of interest and the measure of other constructs [53]. Evidence of discriminant validity can be demonstrated when the squared root of the average variance extracted (AVE) for each construct is higher than the correlations between it and all other constructs. As summarized in Table 2, the square root

of AVE for each construct was greater than the correlations between them and all other constructs. The results suggested an adequate discriminant validity of all constructs.

**Table 1. Psychometric properties of measures**

Construct	Item	Loading	t-value	Mean	SD
<b>Perceived Enjoyment</b> CR = 0.92 AVE = 0.71	PE1	0.84	59.59	6.00	0.89
	PE2	0.83	53.18	5.95	0.90
	PE3	0.84	59.92	5.92	0.90
	PE4	0.84	67.32	5.95	0.92
	PE5	0.82	44.04	6.04	0.86
<b>Withdrawal</b> CR = 0.94 AVE = 0.85	WI1	0.91	94.93	4.75	1.51
	WI2	0.92	103.49	4.07	1.66
	WI3	0.94	152.48	4.34	1.70
<b>Positive Affect</b> CR = 0.88 AVE = 0.61	PA1	0.65	19.51	5.27	1.11
	PA2	0.81	45.23	5.70	0.99
	PA3	0.83	50.92	6.01	0.94
	PA4	0.82	41.93	5.88	0.94
	PA5	0.78	34.94	5.56	1.02
<b>Negative Affect</b> CR = 0.94 AVE = 0.78	NA1	0.90	90.28	3.18	1.62
	NA2	0.87	42.59	3.77	1.82
	NA3	0.84	46.28	3.56	1.70
	NA4	0.92	110.90	3.22	1.71
	NA5	0.89	85.33	3.57	1.89
<b>Excessive use of MMOGs</b> CR = 0.88 AVE = 0.70	EU1	0.80	34.70	5.18	1.38
	EU2	0.87	46.15	5.15	1.42
	EU3	0.84	39.48	5.09	1.51

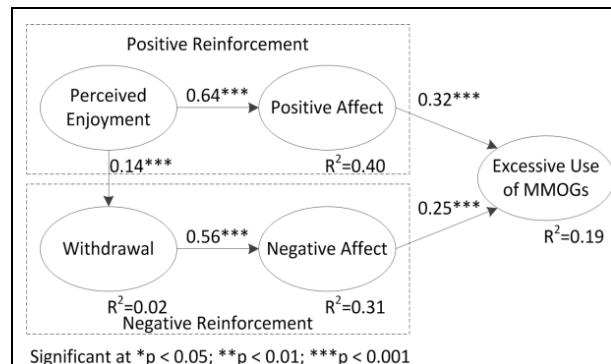
**Table 2. Correlation Matrix**

	PE	WI	PA	NA	EU
<b>Perceived Enjoyment (PE)</b>	<b>0.84</b>				
<b>Withdrawal (WI)</b>	0.14	<b>0.92</b>			
<b>Positive Affect (PA)</b>	0.64	0.31	<b>0.78</b>		
<b>Negative Affect (NA)</b>	-0.04	0.56	0.14	<b>0.88</b>	
<b>Excessive use of MMOGs (EU)</b>	0.31	0.41	0.35	0.29	<b>0.84</b>

Notes: Bolded diagonal elements are the square root of AVE for each construct. Off-diagonal elements are the correlations between constructs.

## 5.2. Structural Model

The structural model analysis was assessed based on the test of the hypothesized effects in our research model. Figure 3 shows the results of the hypothesized structural model test, including the variance explained ( $R^2$  value) of the dependent variables, and estimated path coefficients with significant paths indicated by asterisks. Bootstrap resampling procedure was used to perform the significant test for each path based on our sample ( $n=513$ ) and a 1000 bootstrap subsamples. An examination of the  $R^2$  values demonstrated that the current research model explains a substantial amount of variance in the outcome variable. In our model, it explains 19% of variance in the excessive use of MMOGs. Positive affect and negative affect are significant factors determining the excessive use of MMOGs, with path coefficients of 0.32 and 0.25 respectively. Perceived enjoyment and withdrawal are found to be significant reinforcers activating the reinforcement processes and lead to the associated positive affect and negative affect respectively. Perceived enjoyment is positively associated with withdrawal. The results of this study provide support to all hypotheses.



**Figure 3. PLS results of the structural model**

## 6. Discussion

The primary objective of this study is to advance our understanding on the dark side of hedonic IS/IT use by proposing a theoretical model to explain the development of the excessive use of MMOGs. For this, we proposed a research model based on the addiction literature, and tested it with 513 users of MMOGs in a longitudinal setting. The findings provide support to the positive-negative reinforcement theoretical perspective. Results reveal that affective states (both positive and negative) contribute significantly to the development of the excessive use of MMOGs. In that, users are

encouraged to increase the amount of time as well as the frequency of playing MMOGs to maintain the positive affective state, or to relieve the negative affective state associated with cessation of gaming. Moreover, perceived enjoyment derived from using MMOGs is believed to be a strong stimulus that activates the positive reinforcement, which in turn triggers the activation of negative reinforcement as an opponent. Particularly when the use of MMOGs is stopped or suddenly reduced, withdrawal symptoms arise, leading to an associated negative affective state and serving as an alternative path to the development of the excessive use of MMOGs. Perceived enjoyment derived from playing MMOGs and feeling of withdrawal resulted from the cessation of MMOGs uses are posited to be critical components in the positive-negative reinforcement.

### **6.1. Theoretical and Practical Implications**

First, this study enriches existing IS literature by addressing a previously underexplored research area, the dark side of hedonic IS/IT use. Specifically, we proposed a research model of the excessive use of MMOGs, and explained its development through the positive-negative reinforcement perspective. Both positive and negative reinforcement factors are found important in the current study. We believe that this study adds to the limited research on the problematic hedonic IS/IT use, and allows future studies to be based on.

Second, the empirical evidence provides support to our proposed model that includes perceived enjoyment and withdrawal. Prior literature has mostly implied that perceived enjoyment associated with (hedonic) systems use is beneficial for users [34]. Our study suggests that perceived enjoyment would also contribute indirectly to the development of problematic use of hedonic IS/IT. We provide evidence by empirically demonstrating the significant relationships between perceived enjoyment and positive affect as well as between withdrawal and negative affect.

Finally, the findings of the current study show the influence of both positive and negative reinforcement to the development of the excessive use of MMOGs. Many studies across disciplines have already found that negative reinforcement is more prone to addiction or problematic behaviors [54]. Our results suggest that both positive and negative reinforcement contribute to the excessive use of MMOGs significantly.

From a practical standpoint, the results of this study help raise public and professional awareness of the dark side of MMOG use. Particularly, clinicians,

educators, and users should pay attention to the fact that enjoyment derived from using MMOGs at the first place can later activate positive-negative reinforcement of the gaming behaviors, and lead to the development of excessive use.

In addition, with the rapid development of mobile technologies as well as the seemingly exponential migration of online games to mobile devices, people can now play online games anytime and anywhere. The current study signals an increasing threat to the development of the excessive use of hedonic IS/IT. Enhanced functionality and accessibility of mobile devices and services possibly increase the amount of time people spend on hedonic IS/IT, which may further strengthen the magnitude of positive-negative reinforcement, and increase the likelihood of leading to problematic use of IS/IT.

### **6.2. Limitations and Research Directions**

We acknowledge some limitations of this exploratory research. First, the current research model accounts for 19% variance of the excessive use of MMOGs, there is still much variance to be accounted for. Going beyond the positive-negative reinforcement perspective, there might be other possible mechanisms (e.g., self-regulatory process and habit formation) that would interact with the positive-negative reinforcement and together determine the excessive use of MMOGs. We encourage future studies to explore and involve additional schemes or mechanisms that might potentially explain the development of excessive or problematic use of IS/IT.

Besides those subjective experience variables (e.g., perceived enjoyment, withdrawal and affects) pertaining to the excessive use of MMOGs, specific IS/IT characteristics related to MMOGs have not been examined in the current investigation. We acknowledge that specific IS/IT features (e.g., achievement, social and immersion functionalities inherent in MMOGs) might play a crucial role in determining the formation of the excessive use. Future studies should explore how these specific features embedded in MMOGs affect the development of problematic use.

Last but not the least, research on dark side of IS/IT use has been receiving increased attention across disciplines, but there is still a general lack of consistence in operationalizing and measuring the key constructs related to addictive or problematic usage. Scholars should devote more effort elucidating the related constructs and developing reliable and valid scales to measure problematic use of IS/IT.

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2. I become angry when I am unable to play MMOGs.
3. I become stressed when I am unable to play MMOGs.

#### **Positive & Negative Affect Schedule [56]**

1. Positive Affect: inspired\ alert\ excited\ enthusiastic\ determined
2. Negative Affect: afraid\ upset\ nervous\ scared\ distressed

#### **Excessive use of MMOGs [38]**

1. I spend a good deal of time playing MMOGs.
2. I play MMOGs longer than intended.
3. I lose track of time when I am playing MMOGs.

## **Appendix A**

### **Perceived Enjoyment [2]**

1. Playing MMOGs is enjoyable.
2. Playing MMOGs is pleasurable.
3. Playing MMOGs is fun.
4. Playing MMOGs is exciting.
5. Playing MMOGs is interesting.

### **Withdrawal [55]**

1. I feel bad when I am unable to play MMOGs.