

The Mediating Role of Impulsivity and the Moderating Role of Gender Between Fear of Missing Out and Gaming Disorder Among a Sample of Chinese University Students

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Abstract

The role of fear of missing out (FoMO) in addictive behaviors has recently attracted growing attention. In view of negative effects of gaming disorder (GD) among adolescents and emerging adults, research examining the relationship between FoMO and GD is needed, alongside the roles of impulsivity and gender in the relationship between FoMO and GD. This study examined whether impulsivity as a mediator and gender as a moderator impacted on the relationship between FoMO and GD among a sample of Chinese university students. A sample of 1,288 Chinese university students from three universities completed an online survey through the *Wenjuanxing* platform. The Chinese Trait-State Fear of Missing Out Scale, the Barratt Impulsiveness Scale-Brief, and the Chinese Gaming Disorder Scale were used in this study. The model results indicated that impulsivity partially mediated the relationship between FoMO and GD, and that there was a larger effect size between impulsivity and GD among males. High levels of FoMO among individuals may impact on executive functions leading to more impulsivity, and are associated with GD. Gender may moderate the relationship between impulsivity and GD. This study deepens the understanding of the relationship between FoMO and GD, and provides new perspectives for practitioners to incorporate into health prevention programs to help regulate emotion, control impulsivity, and decrease GD.

Keywords: FoMO, gaming disorder, impulsivity, gender, Chinese university students

1. Introduction

With the rapid growth of online gaming, the number of people with gaming disorder (GD) has also increased, especially for vulnerable individuals who may be at greater risk of developing problematic or addictive gaming behavior¹⁻³. In the gaming studies and behavioral addiction fields, GD is a term that is sometimes used interchangeably with gaming addiction, problematic gaming, and internet gaming disorder (IGD), and has become a 'hot' issue in the field of behavioral addiction⁴. The prevalence of problematic online gaming in China has been reported as ranging from 3.5% to 17%⁵. Some scholars have found that problematic gaming is often experienced by adolescents and emerging

adults⁶⁻⁸. Anxiety and impulsivity have been identified to be significantly associated with IGD⁹. There have been many studies examining the risk factors for GD and these include gaming features (e.g., realistic graphics, high event frequency, and intermittent reinforcement¹⁰⁻¹³), gaming genre (e.g., massively multiplayer online role-playing games [MMORPGs], multiplayer online battle arena [MOBA] games, and real-time strategy [RTS] games)¹³⁻¹⁵, psychopathological symptoms (e.g., anxiety and depression)¹⁵⁻¹⁶, and personality traits (e.g., impulsivity, introversive and egoistic traits)^{9,17-19}, as well as low level of emotion regulation²⁰. Moreover, neurobiological factors (e.g., limbic and prefrontal-striatal systems, neurotransmitters) have also been identified as being associated with GD²¹⁻²⁶.

Recently, some studies have focused on 'fear of missing out' (FoMO), which is positively associated with excessive social media use²⁷⁻²⁹. FoMO has been described as "a pervasive apprehension that others might be having rewarding experiences from which one is absent"³⁰. Trait-FoMO refers to one of the predispositions in developing state-FoMO, whereas state-FoMO refers to an unstable and situated cognition concerning the fear of missing out on something online which could impact on internet-communication disorder via avoidance expectancies³¹. Some scholars have also reported that both state FoMO and problematic Instagram use can mediate the relationship between trait-FoMO and phubbing³².

The Interaction of Person-Affect-Cognition-Execution (I-PACE) model describes the psychological and neurobiological processes of addictive behaviors (e.g., gaming disorder, gambling disorder, etc.), which are considered as a consequence of the interactions

between predispositions, affective and cognitive responses to situational triggers, and executive functions (e.g., impulsive decision-making and inhibitory control)³³. Based on the I-PACE model, trait-FoMO as one of predispositions and state-FoMO as a specific cognition would both impact on inhibitory control of executive functions and trigger impulsive behavior, and in some cases give rise to addictive behaviors.

FoMO may mediate the impact of social identity in gaming disorder among MMORPGs gamers⁴³. Studies have found that game genre is associated with GD, and that MMORPGs have the strongest positive association with GD¹³. In MMORPGs, gamers need to complete tasks or 'quests' with others⁴⁴⁻⁴⁵. Owing to the characteristics of MMORPGs and multiplayer online battle arena [MOBA] games including socializing, relationship, and teamwork⁴⁵⁻⁴⁶, gamers fear of missing out on social communication, collaboration and/or competition, which may lead to impulsive and disordered gaming behavior.

In addition, fear and anxiety often co-occur and commonly overlap. Anxiety disorder and fear-related disorder have been formally classified in the eleventh revised edition of the International Classification of Diseases⁴⁷ (ICD-11). González-Bueso et al.¹⁷ reported that there was a large and significant correlation between IGD and anxiety¹⁷. Trait-anxiety and state-anxiety are predictors of IGD, with state-anxiety being stronger than trait-anxiety¹⁹. The classification of trait-FoMO and state-FoMO is similar to trait-anxiety and state-anxiety. FoMO is regarded as a type of social anxiety⁴³. Social anxiety has also been found to impact on IGD via motives and metacognitions of online social interactions⁴⁸.

Moreover, FoMO may also stimulate impulsive consumption in marketing and

communication activities because of fearing of missing out on something⁴⁹. Kim et al.⁵⁰ also reported that FoMO was an extrinsic motivation (e.g., “It’s a big game not to miss out”) that may promote popular sport event consumption (e.g., Olympics, FIFA World Cup, the Super Bowl). In China, 15.2% of participants in one study reported having an experience of severe FoMO⁵¹. According to the latest report from the China Internet Network Information Centre, the number of individuals (older than six years) who play online games increased to 540 million (57.4% of all internet users) in June 2020⁵². In some Chinese universities, research has indicated that online games may lead to academic difficulties, compromise interpersonal relationship, and impact negatively on the mental and physical health, and can result in a minority of students dropping out of their studies. Considering the prevalence of online gaming in Chinese university students, the present examined the relationship between FoMO and GD, the mediating role of impulsivity, and the moderating role of gender.

1.1. Impulsivity as a mediator

Impulsivity is a tendency including a variety of components, such as a lack of thorough consideration and planning for the future, seeking excitement, taking risks, and rapid decision-making⁵³⁻⁵⁵. Impulsivity is considered as a consequence of neuropsychological impairments in executive functions and attention processes⁵⁶. Reduced executive control is one of the important mechanisms explanations for IGD⁵⁷. Therefore, impulsivity is also a core process underpinning both behavioral and substance addictions⁵⁸.

The pooled findings in a recent systematic review of 33 studies suggested that there was a positive association between impulsivity and IGD⁵⁶. Some scholars note that

impulsivity appears to be one of the forceful personality factors of GD, especially among adolescents and emerging adults^{56,59-63}. Impaired self-control (i.e., impulsive thinking or behaviors) may mediate the relationship between daily need frustration and GD⁶⁴, which is consistent with self-determination theory (SDT) and recent studies⁶⁵⁻⁶⁶. Moreover, the I-PACE model describes risk factors of GD including an individual's core characteristics (e.g., trait-FoMO and impulsivity traits), perception of external and internal triggers (e.g., state-FoMO and stimuli-specific reductions in inhibitory control), and gratification/compensation (e.g., diminished control over addictive behaviors [impulsive behavior]) in addictive processes³³.

1.2. Gender as a moderator

The highest level of FoMO appears to be among young males as opposed to females³⁰. However, some studies have reported that females as having a higher level of FoMO than males^{39,67-68}, as well studies reporting no difference⁶⁹. Therefore, gender differences concerning FoMO are worthy of further investigation.

The importance of gender differences was discussed in addictive disorders, including internet addiction and gambling disorder⁷⁰. Gender difference as a moderator was found in the relationship between motor impulsivity and problematic internet use (PIU), wherein females with higher motor impulsivity had increased PIU levels⁵³. Some studies have also found that gender may moderate the relationships between impulsivity and risky sex, as well as impulsivity and eating disorder⁷¹⁻⁷³. Higher impulsivity is associated with increased use of alcohol, nicotine, and caffeine, especially among males⁷⁴⁻⁷⁵.

Many empirical studies have investigated the relationship between GD and gender.

These have consistently found that males are significantly more likely to have GD^{7-8,76}. Males with GD have lower seed connectivity between the posterior cingulate cortex (PCC) and the orbital part of the left superior frontal gyrus (SFG) than females with GD⁷⁷. Clinical evidence has shown that emerging adults and males with GD appear to be more common⁷⁸. However, some studies reported that females were more vulnerable to GD than males based on evidence concerning cue-elicited cravings and cortical thickness⁷⁹⁻⁸⁰. Therefore, gender differences concerning GD from a neurobiological perspective are not as consistent as those from an epidemiological perspective.

1.3 The present study

Individuals with high FoMO may positively seek social involvement to avoid social anxiety. Gamers, especially males, may show more impulsive behavior, which subsequently may lead to GD. In the present study, the association among FoMO, impulsivity, GD, and gender was examined. It was hypothesized that (i) FoMO would be associated with impulsivity and GD; (ii) impulsivity as a mediator would impact on the relationship between FoMO and GD; and (iii) gender would moderate the association between FoMO and GD (see Figure 1).

1. Methods

2.1. Participants

A cross-sectional study was conducted from October 2019 to April 2020. The survey was performed via Wenjuanxing (an established online survey platform in China). The original sample of 1,447 participants was recruited from three universities in Jiangxi and Liaoning

provinces of China by clustering convenience sampling. Participants needed to meet the condition of playing videogames in the past 12 months via computer, smartphone and/or console. However, 78 participants did not meet the aforementioned condition and 81 participants did not complete all the survey questions. Therefore, data from 159 participants were excluded. A total of 1,288 participants remained (526 males, 762 females) with 89% response rate. Participants were aged between 17 and 25 years (mean age=20.0 years \pm 1.6). The average time spent gaming each day was 3.11 hours.

2.2. Measures

2.2.1. Chinese Trait-State Fear of Missing Out Scale (T-SFoMOSC)

The Trait-State Fear of Missing Out Scale (T-SFoMOS) was used to assess the level of fear of missing out³¹, and was translated into Chinese⁸¹. The 12-item T-SFoMOS includes a trait-FoMO dimension (e.g., *"I get worried when I find out my friends are having fun without me"*) and a state-FoMO dimension (e.g., *"I am continuously online in order not to miss out on anything"*). Participants rate items on a five-point scale (from 1=*"totally disagree"* to 5=*"totally agree"*). The Cronbach's alpha and McDonald's ω for the total scale were 0.81 and 0.82, respectively in the present study.

2.2.2. Barratt Impulsiveness Scale-Brief (BIS-Brief)

The Barratt Impulsiveness Scale-Brief (BIS-Brief)⁸² was utilized to assess impulsivity⁸³⁻⁸⁴. The BIS-Brief has eight items and was developed by Patton et al.⁸⁵, and was translated into Chinese⁸⁶. Participants rate the items on a four-point scale (from 1=*"rarely/never"* to 4=*"almost always/always"*). The Cronbach's alpha and McDonald's ω were both 0.70 in

the present study.

2.2.3. Chinese Gaming Disorder Scale

The Chinese Gaming Disorder Scale (CGDS) developed by the present authors [reference masked for blind review] was utilized to assess GD. The nine items were adapted from the ICD-11⁴⁷ (e.g., *“I increase priority given to gaming to the extent that gaming takes precedence over my other life interests and daily activities”*) and the fifth edition of *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*⁸⁷ (e.g., *“I feel the need to spend increasing amount of time engaged gaming in order to achieve satisfaction or pleasure”*). Participants respond with ‘1=yes’ or ‘0=no’. The nine-item CGDS model with two-factor was verified by fit indices ($\chi^2=64.71$, $df=26$, $p<.01$; TLI=0.927; CFI=0.947; SRMR=.036; RMSEA=.036). The Cronbach’s alpha and McDonald’s ω of the CGDS in the present study were 0.73 and 0.74, respectively.

2.3. Procedure

From October 2019 to April 2020, participants were recruited from three universities (Gannan Medical University [731 participants], Jiangxi University of Science and Technology [418 participants], and Jinzhou Medical University [298 participants]) in two provinces of China. Following the students’ approval to gain course credit, the online survey was completed in normally scheduled classes. Participants took approximately five minutes to complete all the questions.

2.4. Statistical analysis

Descriptive statistics and Pearson's and Spearman's correlation were performed using SPSS 20. Bayesian correlation was performed using JASP (Jeffrey's Amazing Statistics Program). $\text{LogBF}_{10} \geq 3$ and $\leq 1/3$ are evidence for the null hypothesis (i.e., there is a correlation between variables)⁸⁸. The Cronbach's alpha and McDonald's ω were also calculated using JASP. The mediating role of impulsivity was examined using PROCESS macro for SPSS (Model 4), whereas the moderating mediation model of impulsivity and gender was conducted using PROCESS macro (Model 59). In addition, the significance of mediating and moderating effects were examined using a bias-corrected bootstrapping method, which is regarded as significant if the confidence intervals (CIs) do not include zero⁸⁹.

2. Results

3.1. Descriptive statistics and correlation analyses

Table 1 shows the means, standard deviations, skewness, kurtosis, Pearson correlations, Spearman correlations, and Bayesian correlation. The skewness (< 2) and kurtosis (< 7) level of the study variables indicated a normal data distribution⁹⁰. FoMO, trait-FoMO and state-FoMO were significantly positively associated with impulsivity ($r=0.17$, $r=0.18$, $r=0.11$, all $p<.001$; $\log(\text{BF}_{10})=13.34$, 17.04 , 3.42 , all >3) and GD ($r=0.12$, $r=0.10$, $r=0.10$, all $p\text{-values}<.001$; $\log(\text{BF}_{10})=4.42$, 2.69 , 1.76 ; $\text{FoMO}>3$), respectively. GD was significantly associated with gender ($r=0.30$, $p<.001$; $\log(\text{BF}_{10})=21.81>3$). Bayesian correlation verified the effect sizes of the relationship between FoMO, impulsivity and GD.

3.2. Testing for mediation effect

Impulsivity as a mediator impacting on the relationship between FoMO and GD was examined utilizing Hayes' PROCESS (Model 4). FoMO was positively associated with impulsivity ($\beta=0.17$, $t=5.99$, $p<.001$) and GD ($\beta=0.08$, $t=3.11$, $p<.01$). Impulsivity was positively associated with GD ($\beta=0.16$, $t=6.51$, $p<.001$). The total effect ($\beta=0.102$, 95%CI: 0.054, 0.150) and indirect effect ($\beta=0.031$, 95%CI: 0.018, 0.045) from FoMO to GD via impulsivity were both significant. Therefore, the relationship between FoMO and GD was partially mediated via impulsivity.

3.3. Testing for moderated mediation

The moderated mediation effect of impulsivity as a mediator and gender as a moderator between FoMO to GD were examined using Hayes' PROCESS (Model 59). The results of the moderated mediation analysis are displayed in Table 2. As Model 2 showed, the effect of impulsivity on GD was moderated by gender ($\beta=-0.15$, $t=-3.36$, $p<.001$), but not the effects of FoMO on impulsivity and FoMO on GD. Figure 2 shows the relationship between impulsivity and GD at males and females ($M+1SD$ and $M-1SD$)⁹¹. A simple slope test⁹² showed that the positive relationship between impulsivity and gaming disorder was statistically significant among males ($\beta=0.26$, $t=7.41$, $p<.001$) and females ($\beta=0.10$, $t=3.47$, $p<.001$), but the effect size was much smaller among females.

3. Discussion

The present study examined the moderated mediation effect of impulsivity as a mediator and gender as a moderator between FoMO to GD among a sample of Chinese

university students. The findings provide insight into impulsivity mediating the relationship between FoMO and GD as well as gender moderating the relationship between impulsivity and GD. FoMO was positively associated with impulsivity, which was similar to Aydin et al.'s research on impulsive buying⁴⁹. In addition, FoMO has also been found to be closely related to impulsive social communication via excessive smartphone use⁹³. Therefore, higher levels of FoMO may negatively impact executive function and trigger impulsive behavior. Some participants reported habitually or impulsively checking their smartphones even if the phones did not receive any new information⁹⁴, because they feared missing out on something important. FoMO was also significantly positively associated with GD in the present study, which is similar to Duman and Okzara's research⁴³ (i.e., FoMO was found to be an important predictor of online game addiction among MMORPGs gamers; $\beta=0.16$, $p<.001$, 95% CI: [0.216, 0.478]). Self-determination theory (SDT) has suggested that daily need frustration undermines individual's self-control⁹⁵, whereas FoMO is regarded as an unstable self-regulatory originating from specific deficits in the process of psychological need satisfactions³⁰.

The results identified the partial mediating role of impulsivity from FoMO to GD. Social communication, collaboration and competition are important motivations in MMORPGs and real-time strategy (RTS) games⁹⁶⁻⁹⁸. To satisfy individuals' motivation, gamers with high level of FoMO may lose self-control which gives rise to greater impulsivity, subsequently, and resulting in GD⁹⁹. In term of the I-PACE model, FoMO containing trait and state dimensions, as a specific personality trait or state anxiety, may facilitate impulsivity and impair individual executive function, which may result in GD for a small minority. In

addition, SDT posits that problematic gamers fail to control or cease gaming activity, increase impulsivity in order to achieve instant satisfaction and pleasure, and subsequently leads to GD in some individuals, which may be due to the fear of missing out on social interactions or the sense of accomplishment and satisfaction from gaming.

The present study also found that gender as a moderator in the relationship between impulsivity and GD. Compared with females, the effect size between impulsivity and GD was higher among males. The result is consistent with other findings, which have suggested that a minority of female adolescents and a majority of male adolescents play videogames¹⁰⁰. In addition, the prevalence of IGD/GD is higher among males, especially in some Asian countries (e.g., China, Korea)¹⁰¹⁻¹⁰². It has also been reported that boys with problematic internet use are more influenced by genetic factors than girls¹⁰³. Some studies have reported that high levels of testosterone in males may be related to IGD, such as exhibiting more impulsive and aggressive behaviors¹⁰⁴. Moreover, the altered amplitude of low-frequency fluctuation (ALFF) values in the orbital part of the left superior frontal gyrus (SFG) represented a clinically relevant biomarker for inhibition control of IGD among males⁷⁷. This means that IGD may interact with sex-specific patterns of functional connectivity.

Impulsivity as a mediator and gender as a moderator appears to impact the relationship between FoMO and GD among Chinese students. Nevertheless, several limitations should be noted in the present study. First, the data were collected via self-report and a convenience sample was used, which may result in some response biases, such as memory recall, individual motivation, and social desirability. The sample may also be

unrepresentative of Chinese university students. Future studies should utilize representative random samples and utilize longitudinal and other more objective methodologies to further explore the relationship between FoMO, impulsivity, and GD (e.g., clinical assessment, fMRI techniques, and cohort-sequential longitudinal design). Second, there were possible confounding variables. For instance, social networking site (SNS) addiction and smartphone addiction were not controlled for in the present study. Furthermore, the impact of different videogame genres should also be identified in future study, particularly because undefined gaming genres (including casual games, puzzle games, etc.) may have contributed to low correlations and regression coefficients in the present study. Third, further research is required to give more insight into the features of trait and state dimension of FoMO. For example, studies could evaluate the difference between trait and state dimension of FoMO, which are considered as predictor variables that impact on GD. Moreover, further research may be necessary to delineate the differences between the different gaming genres (e.g., MMORPGs, RTS games, First Person Shooter games, and Multiplayer Online Battle Arena [MOBA] games) and the impact of different gaming genres in the relationship between FoMO, impulsivity, and GD. Despite these limitations, the results of the present study demonstrate the moderating mediation effects of impulsivity as a mediator and gender as a moderator from FoMO to GD. Based on the findings, the impact of FoMO on GD among Chinese university students may be moderated by gender and mediated via impulsivity.

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