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ORIGINAL ARTICLE

Need Frustration, Gaming Motives, and Internet Gaming Disorder in Mobile Multiplayer Online Battle Arena (MOBA) Games: Through the Lens of Self-Determination Theory

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Abstract
Playing mobile MOBA games has become a popular leisure activity among Malaysian youth. However, MOBA games are highly addictive and have negative impacts on adult development. Inadequate local studies investigated the risk factors of excessive MOBA gameplay. The present study examined the (1) predictive role of need frustration on Internet gaming disorder (IGD) and (2) mediating effect of gaming motives. A total of 398 mobile MOBA gamers aged 18 to 29 participated in this cross-sectional online survey study. The findings showed that need frustration positively predicted IGD. Social, escape, competition, coping, and skill motives were significant mediators for the association between need frustration and IGD. However, fantasy and recreation motives were not significant mediators. MOBA players who were frustrated while fulfilling their basic needs may succumb to uncontrollable gaming behavior. Therefore, future prevention and intervention programs should cultivate positive mental strength for youth while meeting their basic needs.

Keywords Need frustration · Internet gaming disorder · Gaming motives · Youth · MOBA

Over the last two decades, video game playing has shown exponential growth and increasingly become a popular leisure activity worldwide (Bányai et al., 2019a). Online video gaming is one of the most popular leisure activities globally (Ballabio et al., 2017). The previously famous computer games have now shifted to mobile devices, given the rapid development of mobile technology and its convenient accessibility (Lin et al., 2021). Nowadays, mobile gaming has pervasively penetrated the Asia market, and such phenomenon has triggered greater scholarly interest (e.g., Tran et al., 2020; Wang et al., 2019). Mobile games refer to games that single or multi-players can play via mobile devices. They are typically available for free, but charges are needed for extra features (Su et al., 2016). During the COVID-19

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pandemic, engagement with video games is at an all-time high, and gameplay has become a mainstream pastime (Nielsen, 2020).

The gaming industry is a significant revenue generator, bringing players worldwide to work through tournaments, leagues, and competitions (Straits Research, 2020). Newzoo (2022) has also reported that mobile game revenues account for 52% of the global gaming market, signifying that the mobile gaming industry is booming drastically with its expeditious innovation. Among the various mobile games' genres, the most played mobile game genres worldwide are cooperative and multiplayer (Statista, 2021a). Multiplayer online battle arena (MOBA) is one of the popular genres which incorporated cooperative and competitive elements. It is also a sub-genre that originated from a modified version of real-time strategy (RTS) (Silva et al., 2017). The popular MOBA gaming apps include *Honor of Kings, Mobile Legends: Bang Bang, Leagues of Legends, Pokémon UNITE, Onmyoji Arena,* and *Arena of Valor*. Newzoo (2020) reported that the surge in Southeast Asia (SEA) smartphone users has led SEA to become one of the fastest-growing mobile games markets globally, particularly with 17.4% of year-on-year growth. Mobile game revenues achieved the highest, which account for 69.4% compared to personal computers (22.3%) and consoles (8.3%). The mobile-first in SEA's gaming industry reveals its high growth potential. Expectedly, the gaming companies would invest more resources in obtaining more mobile dominance and market share. Malaysia is one of the significant countries that make up the majority of the SEA game market. In Malaysia's market, the MOBA genre is the most popular. For instance, 35% of Malaysian online players have experienced playing the most popular MOBA game (e.g., *Mobile Legends: Bang Bang*) in the past 6 months.

An online survey by Statista (2021b) reported that 42% of Malaysian youth play mobile games daily. Consistently, Chen et al. (2020) revealed that Malaysian youth spend more time engaging with mobile gaming applications. This prolonged mobile usage has induced adverse consequences on physical health, such as migraines, vision difficulties, obesity, musculoskeletal pain, and other physical discomforts. Another local study by Syed Esa et al. (2018) posited that Malaysian youth with excessive mobile device usage could negatively influence their self-control to combat addictive gaming tendencies. Over the lifespan, young adults are more vulnerable to online-related addictions (Stone et al., 2012; Sussman & Arnett, 2014). Despite the far-reaching popularity of MOBA games, there were still inadequate local studies investigating its potential risk factors among youth in Malaysia. Rosendo-Rios et al. (2022) postulated that the risks and awareness of IGD have been expanding. Therefore, there is a constant need to capture up-to-date knowledge in this research area, shaping future directions for research, practice, and policy. The fast-paced online gaming landscape over the past few years (e.g., the shift from computer games to mobile games) reflects an important gap in the literature for further examination. The present study aims to focus on youth aged between 18 and 29 years old according to the suggested age range by the Malaysia Youth Policy (Ministry Youth and Sport, 2018).

American Psychiatric Association (APA, 2013) has included IGD into Section III of the Diagnostic and Statistical Manual of Mental Disorders-fifth edition (DSM-5). IGD has been regarded as the relentless use of online video games, leading to players' psychological distress. The disorder notion has been widely applied across disciplines, despite numerous ongoing debates concerning the suitability of the listed assessment criteria in DSM-5 (Griffiths et al., 2016). Nevertheless, growing research (e.g., André et al., 2020; Goh et al., 2019; Verlinden et al., 2021) reported that excessive gameplay could lead to functional impairment or destructive consequences on physical and mental health. A systematic literature review by Rosendo-Rios et al. (2022) suggested that most empirical studies were conducted mainly in the USA, UK, the Netherlands,

and Germany. Studies on less-explored countries where online gaming addiction is increasingly becoming a societal challenge should be conducted for the betterment of future research endeavors.

Theoretical Framework

Self-determination theory (SDT) by Ryan and Deci (2017) is a well-developed, macro motivational theory constituted by six mini theories. Basic psychological needs theory (BPNT) is one of these mini theories, highlighting one's satisfaction with the basic psychological needs that can lead to positive outcomes (e.g., better health and psychological well-being). Three psychological needs, autonomy (i.e., perceive one's actions and cognitions in an activity are under own control), competence (i.e., perceive a sense of self-efficacy and mastery), and relatedness (i.e., perceive a sense of connectedness with others), are postulated to be innate human needs. Ryan et al. (2006) posited that games primarily motivate players to experience these three needs: autonomy, competence, and relatedness. Need satisfaction is essential for human well-being as it predicts smooth daily functioning across levels of people (Martela et al., 2016). SDT has a five-decade history; however, the concept of need frustration (being a distinct construct from need satisfaction) has recently received scholarly attention. Need frustration was suggested as a distinct construct that does not equitably define as lack of need satisfaction, as it requires the environment to actively thwart satisfaction need (Bartholomew et al., 2011a; Liga et al., 2018; Mills & Allen, 2020). Need frustration is an individual's extent to feel obstructed in satisfying their three psychological needs (i.e., autonomy, competence, and relatedness) in daily life. Mills and Allen (2020) described that need frustration includes being forced to act uneasily (autonomy frustration), feeling inferior due to poor ability (competence frustration), and being rejected or isolated by the social agents (relatedness frustration) unwillingly. Need frustration across life domains may also trigger one's dependence on an activity while pursuing needs satisfaction, fostering a maladaptive engagement. Therefore, it is closely associated with an individual's ill-being (Vansteenkiste & Ryan, 2013). Need frustration was also suggested that it does not reside on a single continuum with need satisfaction. Each of the needs carries unique outcomes on human development (Sheldon & Hilpert, 2012).

SDT focuses on factors that either foster or undermine one's motivation, which can be intrinsic or extrinsic. Intrinsic motivation underlies gaming behavior, which most players do not gain extra-game rewards or approval. Therefore, most players pay money to be involved, even being rejected to participate. Thus, it can be described that such gaming behavior is intrinsically satisfying. Wan and Chiou (2006) also reported that intrinsic motivations (e.g., curiosity, exploration, a sense of belonging, autonomy, and competence) play a more significant role in the development of game addiction than extrinsic motivations (e.g., a compliment from others, power, fame). Similarly, Ryan et al. (2006) also empirically tested SDT among massively multiplayer online (MMO) players, which is another game genre. Specifically, autonomy and competence play significant roles in player motivation and enjoyment. The nature of the MMO game genre allows players to have rich interaction. Thus, the interaction fosters a stronger psychological need for relatedness, an essential source of a sense of presence, game enjoyment, and stronger intention for future play.

Need Frustration and IGD

Need satisfaction leads to better psychological well-being, whereas need frustration brings more detrimental effects. Video games allow the fulfilment of three psychological needs (i.e., autonomy, competence, and relatedness) for compensating the highly frustrating physical world (Rigby & Ryan, 2011). Most games allow players to exert autonomy over the in-game pursuits (to satisfy the autonomy need), exercise their skill and knowledge while facing challenges (to meet the competence need), and cultivate social connections (either with peers or in-game characters for fulfilling relatedness need) (Allen & Anderson, 2018). Examining need frustration—rather than lack of satisfaction—is more scholarly valuable. Drawing on the empirical studies (e.g., Allen & Anderson, 2018; Mills et al., 2018), daily need frustration significantly predicts problematic gaming. It is posited that excessive gaming is used as a maladaptive coping strategy to compensate for or escape from highly frustrating everyday life (Kardefelt-Winther, 2017).

Furthermore, Allen and Anderson (2018) revealed that frustration in the real world yields a more robust association with well-being than frustration in video games. In other words, need frustration in the real world is negatively related to well-being. Similarly, Przybylski et al. (2009) also reported that obsessive passion for gaming (a construct that is closely related to IGD) predicts more intensive gameplay but less game enjoyment, mainly when individual needs are frustrated. Thus, pathological gaming may continue to develop, even experiencing frustrations from in-game pursuits and lesser game enjoyment. To the best of our knowledge, the relation between the need frustration of MOBA players and IGD has not been adequately examined. The present study was conducted to address the gap in the literature.

Need Frustration, Gaming Motives, and IGD

The present study serves as one of the few studies investigating the roles of daily need frustration and gaming motives in explaining IGD among MOBA players. Mills et al. (2017) examined the roles of need frustration, motivation of gaming on problematic video gaming. However, the study assessed gaming motivation using Lafrenière et al. (2012) motivational approach, focusing on intrinsic motivation, amotivation, and four subtypes of extrinsic motivation toward gaming. The motivational approach might restrict a more comprehensive picture of the complexity of motivational differences. Articulating motivational differences among players is the precursor to understand complex gaming behavior and its environmental interaction. It also provided a framework to differentiate one player from another (Yee, 2007). The present study was conducted in line with the recommendations by Mills et al. (2018) by explicitly examining the complex interplay between IGD and SDT.

Demetrovics et al. (2011) operationalized the motivational basis of online games with seven dimensions (i.e., social, escape, competition, coping, skill development, fantasy, and recreation). It is important to note that gaming has satisfied various needs of players with diverse motivational backgrounds. Social motive refers to the need for a player to interact with others, be with others, and play with others. Escape motive is about a player's desire to run away from stressful life issues. Competition motive describes a player's desire to defeat others, achieving a sense of accomplishment in gameplay. Coping motive is where players are involved in gameplay for coping with distress and improving mood. Skill development

motive is a player's desire to learn or enhance gaming skills (e.g., concentration, coordination). Fantasy motive refers to intense satisfaction gained from immersing themselves in an appealing virtual gaming world and trying things that one cannot do in the physical world. Recreation motive is a player's desire to play games for relaxation, pleasure, and to get rid of boredom.

In line with SDT, the degree of motivation to engage in any activities is primarily determined by the degree to which the three basic psychological needs (i.e., autonomy, competence, and relatedness) are satisfied. Therefore, players with intense need frustration struggle to fulfil their basic psychological needs or experience an adverse environment that can thwart the needs. Scerri et al. (2019) stated that a stronger need frustration in real life might resort to stronger motivation in gaming, given the alluring contingencies provided by this appealing virtual world. Gaming offers an accessible and immediate means to satisfy the deficits in the three needs, driving an individual to achieve an overall sense of validation.

Generally, when a mobile player's basic psychological needs are frustrated during gameplay (e.g., being forced to act against their volition, cannot be competent, or feeling rejected or isolated), the symptoms of IGD can easily emerge. They are likely to exhibit an obsessive form of gaming behavior, reaching an extent that players have little control (e.g., Mills et al., 2018; Tóth-Király et al., 2019). Although mobile games have less sophisticated features, they can still produce addictive behavior. *Social* players expect mobiles games to alleviate feelings of loneliness and strengthen social relatedness. Therefore, the direct effect of need frustration on IGD is potentially mediated by one's social motive for gaming. Players are motivated to play games as they expect that gaming can elicit a compensatory effect, facilitating pathological development (Wegmann & Brand, 2020).

The escape theory by Baumeister (1991) described that when people encounter setbacks or stressful life events, they are more likely to *escape* into a relatively numb state of cognitive deconstruction. The appealing virtual world may temporarily take escapists' minds off their real-life problems, leading to uncontrollable play. However, if there is an alternative way to alleviate the unpleasant experience in the real world, escapists may reduce their online gaming substantially (Zhong & Yao, 2013). Furthermore, players who drive to seek personal achievement in *competitive* cyberspace are more vulnerable to play games compulsively. King et al. (2017) also postulated that achievers would invest more resources in pursuing their targeted goals when the expected outcome is not attained.

Additionally, Snodgrass et al. (2014) reported that highly stressed players magnify the stress and sufferings in their real lives by playing games problematically. They were prone to seek refuge from their offline problems as a *coping* strategy. In other words, problematic online gameplay reflects a response to life stressors. A high *skill development* motive is a fundamental criterion for esports players but not general players. They have to invest more resources in obtaining deep knowledge about a game, thinking strategically and making good decisions (Himmelstein et al., 2017). However, Bányai et al. (2019b) explained that skill development motive did not significantly contribute to gaming disorder among recreational and esports gamers. Hence, more studies are needed to unveil the role of this motive in pathological gaming. The motive of *fantasy* is about experimenting with new identities and living out new experiences that are not possible in the physical world. Past studies (e.g., Ballabio et al., 2017; Klinger et al., 2009) reported that fantasy motive is weakly associated with problematic online gaming but highly associated with escapism (in which the virtual gaming world is used to avoid real-life problems), providing a temporarily psychological relief. However, this explanation requires further empirical confirmation. In contrast, Király et al. (2015) reported no significant relationship was found between fantasy motive and IGD.

Lastly, Zhong and Yao (2013) revealed that motivation to relax (closely represent the *recreational* motive) did not significantly contribute to the two symptoms (i.e., problems and salience) of gaming addiction disorder but not uncontrollable play. It can be explained that entertainment gamers distinguish well between the virtual world and the physical world. They might be too rational to be affected by games. For them, a game is merely for entertainment purposes. They would not easily allow online games to replace essential aspects of life. They tend to be less susceptible in experiencing IGD symptoms. They are also not interested in seeking achievements or rewards through gameplay. The consumption of gameplay is not necessarily goal-driven but merely for pleasure.

The Present Study

The present study applies SDT to examine the predictive role of need frustration on IGD among mobile MOBA gamers aged 18 to 29 in Malaysia. Despite examining the direct effect, the present study also explores the mediating effect of gaming motives (i.e., social, escape, competition, coping, skill development, fantasy, and recreation) on the association between need frustration and IGD. The examination of mediating effects is prominent in developing or strengthening psychological theory and empirical studies. The different motivational types are used as mediators to shed light on the underpinning processes explaining the direct relationship between need frustration and IGD. A more contemporary justification for examining the mediating variable is to apply findings in prevention and treatment. It aims to change the outcome of interest by focusing on the causally linked mediating variable (Agler & de Boeck, 2017). Past studies (e.g., Allen & Anderson, 2018; Kardefelt-Winther, 2017; King et al., 2017; Wegmann & Brand, 2020; Zhong & Yao, 2013) reported findings between need frustration and IGD and gaming motivations and IGD. To the best of our knowledge, only Mills et al., (2017, 2021) examined the mediating roles of three motivational types (a different motivational typology) on need frustration and IGD. Upon reviewing the existing literature, the current empirical findings are scarce to unveil the interaction between the selected key variables of the present study, specifically on the mediating effect. Taken together, the hypotheses of the present study are presented as follows:

H_1: Need frustration of mobile MOBA players positively predicts IGD.
H_2: Social motive significantly mediates the association between need frustration and IGD among mobile MOBA players.
H_3: Escape motive significantly mediates the association between need frustration and IGD among mobile MOBA players.
H_4: Competition motive significantly mediates the association between need frustration and IGD among mobile MOBA players.
H_5: Coping motive significantly mediates the association between need frustration and IGD among mobile MOBA players.
H_6: Skill development motive significantly mediates the association between need frustration and IGD among mobile MOBA players.
H_7: Fantasy motive significantly mediates the association between need frustration and IGD among mobile MOBA players.
H_8: Recreation motive significantly mediates the association between need frustration and IGD among mobile MOBA players.

Method

Participants and Procedure

In the present study, a total of 398 players were recruited. Participants were invited to participate in Qualtrics online survey posted in randomly selected Malaysian MOBA Facebook groups. A list of MOBA games' group was generated by inserting selected keywords (i.e., *Mobile Legends* Malaysia, *Honor of Kings* Malaysia, *DOTA 2* Malaysia, *Leagues of Legends* Malaysia, *Pokémon UNITE* Malaysia, *Onmyoji Arena* Malaysia, *Arena of Valor* Malaysia) into the Facebook search. A random number was assigned for each identified Facebook group and a total of 19 groups were selected. The present study did not aim to examine all genres of mobile online games and the general gamers population. Thus, three inclusion criteria were set for participation: (1) mobile MOBA players, (2) aged 18 to 29 years old (to be consistent with the youth definition suggested by Ministry Youth and Sports (2018), and (3) at least 12 months experience of playing mobile MOBA game(s). A total of 63 sets of responses (15.8%) were removed due to disqualified age, less than 12 months of mobile MOBA gaming experience, and high missing data (more than 50%). The retained ($n = 335$) sample data were predominantly males ($n = 209$, 62.4%) and aged between 18 and 29 ($M_{age} = 22.13$ years; $SD = 1.74$).

The non-probability sampling method, specifically purposive sampling via an online survey, was implemented for data collection. The purposive sampling method allows researchers to collect data by matching the inclusion criteria. For instance, it does not require researchers to identify a sampling frame before starting the data collection (Etikan et al., 2016). According to Daniel (2012), the purposive sampling method is best suited for achieving more homogenous data—matching the three inclusion criteria of the present study, and it is also suitable for the hard-to-reach population due to geographical constraints. The mobile MOBA players might not be easily accessed in public settings. They can be considered a hidden population who do not wish to be easily found or contacted in person (Atkinson & Flint, 2001). Therefore, the selection of the non-probability sampling method fits well in Wegmann & Brand, 2020 has been changed to Wegmann & Brand, 2020 so that this citation matches the Reference List. Please confirm that this is correct. due to the sample characteristics. The procedure steps adhered to the Personal Data Protection Act (n.d.) and the ethical standards of the Helsinki Declaration of 1975, as revised in 2005. The ethical approval was also issued by the Scientific and Ethical Review Committee of the main author's university.

Measures

Internet Gaming Disorder Scale–Short Form (IGDS9-SF)

This unidimensional scale was created by Pontes and Griffiths (2015) to assess IGD symptoms over the past 12-month period. This scale consists of nine items consistent with the nine diagnostic criteria of DSM-5, but the scale was not initially developed for clinical diagnostic purposes but to measure its severity and detrimental effects on gamer's life. For research purposes, it is useful to classify disordered gamers and non-disordered gamers for those who obtained a minimum of 36 out of 45 points (i.e., answered "often" and "very

often" across all items). It is administered by a 5-point Likert scale, ranging from *never* (1) and *very often* (5). The higher the total score, the more severe the gamer experiences the symptoms of IGD. The scale was highly reliable with Cronbach's alpha (α = 0.87).

Psychological Need Thwarting Scale (PNTS)

This 12-item multi-dimensional scale was developed by Bartholomew et al. (2011b). This scale assesses the need frustration in daily life. The original scale has three subscales (i.e., competence, relatedness, and frustration), four items each. The scale is administered by 7-point Likert scale from "strongly disagree" to "strongly agree." The higher the total score, the stronger the frustration an individual experiences in daily life. This scale was found with good reliability (α = 0.92).

Motives for Online Gaming Questionnaire (MOGQ)

This 27-item multi-dimensional scale was constructed by Demetrovics et al. (2011). The scale has seven subscales: social, escape, competition, coping, skill development, fantasy, and recreation. The scale is administered by 5-point Likert scale, ranging from 1 (*never*) and 5 (*almost always/always*). Each player is not classified under a mutually exclusive type as it is expected that a combination of different motives can drive players during gameplay. Each subscale has been treated as a continuous variable. The subscales displayed excellent reliability, specifically social (α = 0.89), escape (α = 0.92), competition (α = 0.87), coping (α = 0.87), skill development (α = 0.91), fantasy (α = 0.84), and recreation (α = 0.80), and the overall scale has α = 0.97.

Statistical Analyses

The present study analyzed the data using SmartPLS version 3.3.2 developed by Ringle et al. (2015). SmartPLS is a prominent software for Partial Least Squares–Structural Equation Modeling (PLS-Sem). David Garson (2016) described several advantages of using PLS: (1) ability to model multiple independent and dependent variables, (2) handle multicollinearity, (3) show good robustness in dealing with data noise and missing data, (4) create independent latent variable directly based on cross-products, and (5) produce robust findings of predictive effects. Hair et al. (2018) advocated that if the research objective focuses on prediction, the choice of methods should be PLS-SEM (consistent with the main research objective of the present study). Henseler et al. (2009) also stated that PLS is strongly recommended for studies at an initial theoretical development stage or exploratory stage. PLS-SEM can handle problematic modelling issues (e.g., nonnormal data), typically found in social science contexts by transforming it according to the central limit theorem (Cassel et al., 1999; Hair et al., 2014). A pilot study was conducted to examine the psychometric properties. Each construct was found to have a good average variance extracted (AVE) above 0.50. Furthermore, Henseler et al. (2015) recommended using a heterotrait-monotrait ratio of correlations (HTMT) for examining discriminant validity, each construct was below the 0.90 cut-off value. As for composite reliabilities, the constructs were above 0.70.

In the actual collected data, the present study first examined common method variance (CMV) because the collected data were from a single source. CMV is defined as a

systematic effort variance shared among variables when the measurement is from the same source or method. Therefore, it is crucial to ensure no violation when the collected data are from a self-administered questionnaire and the same person (Podsakoff et al., 2016). The present study adopted Harman's single-factor test which is a post hoc procedure after data collection to identify whether a single factor is accountable for variance (Chang et al., 2010), and the correlation matrix procedure suggested by Bagozzi et al. (1991). Multivariate normality was also examined by using Mardia's multivariate kurtosis and skewness. PLS models were built upon checking multivariate normality, namely, measurement, and structural models. A measurement model was used to assess psychometric properties (i.e., validity and reliability), and a structural model was used to examine the direct effect and indirect effect (also known as mediating effect). The last analysis was completed by focusing on the out-of-sample predictive power suggested by Shmueli et al. (2016). It is imperative to conduct out-of-sample prediction in an exploratory context, given that a well-fitting model may also perform poorly in out-of-sample prediction, leading to poorer practical usefulness (Shmueli, 2010).

Results

Preliminary Analysis

The multivariate outliers were first diagnosed using the Mahalanobis distance, D^2, measure. A case with a probability of D^2 value less than 0.001 is considered for removal, given that multivariate outlier may lead to biased findings. As such, six cases were detected and 329 sets of responses were retained. The common method variance analyses also were conducted using Harman's single factor test and correlation matrix procedure. The generated output shows no distinct factor emerging from the factor analysis, and the first unrotated factor captures less than 50% of variances. As for the correlation matrix, none of the constructs were above 0.90 (refer to Table 1). Multivariate normality was assessed by using Mardia's multivariate kurtosis and skewness. The results can be viewed at https://webpower.psychstat.org/models/kurtosis/results.php?url=857efd7091960660a5f9a9b9ac3c5e10. The results show a violation of the rule-of-thumb, in which the p value of skewness is statistically significant.

Table 1 Correlation matrix between variables

	1	2	3	4	5	6	7	8	9
1.Social	-								
2.Escape	0.794**	-							
3.Competition	0.822**	0.794**	-						
4.Coping	0.651**	0.840**	0.727**	-					
5.Skill	0.715**	0.772**	0.662**	0.733**	-				
6.Fantasy	0.733**	0.795**	0.778**	0.718**	0.746**	-			
7.Recreation	0.716**	0.664**	0.743**	0.552**	0.647**	0.688**	-		
8.Frustration	0.701**	0.741**	0.670**	0.651**	0.592**	0.650**	0.531**	-	
9.IGD	0.657**	0.715**	0.728**	0.697**	0.521**	0.628**	0.560**	0.655**	-

**Significant at 0.01 level.

Consequently, the multivariate normality assumption is not met. Therefore, this calls for SmartPLS statistical analysis (a non-parametric analysis tool). A detailed demographic characteristic of participants is presented in Table 2.

Table 2 Demographic characteristics of participants

	Frequency	Percentage %
Sex		
Male	207	62.9
Female	122	37.1
Highest education level		
Pre-U/foundation studies	41	12.5
Bachelor's degree	283	86.0
Master's degree/PhD	3	0.9
Others	2	0.6
Racial groups		
Malay	84	25.5
Chinese	136	41.3
Indian	107	32.5
Others	2	0.6
How long have you been playing mobile MOBA games?		
1 to 2 year(s)	100	30.4
3 to 4 years	134	40.7
5 to 6 years	58	17.6
More than 6 years	37	11.2
How frequently do you play mobile MOBA games in general?		
Less than once a month	10	3.0
Once a month	5	1.5
More than once a month	18	5.5
Once a week	11	3.3
More than once a week	67	20.4
Everyday	218	66.3
What is your average time spent on mobile MOBA games per day?		
≤ 1 h	57	17.3
> 1 and ≤ 3 h	199	60.5
> 3 and ≤ 5 h	61	18.5
> 5 h	12	3.6
How frequently do you have in-app purchases in a month?		
None	122	37.1
1 to 5	127	38.6
6 to 10	50	15.2
11 to 15	15	4.6
16 to 20	8	2.4
Above 20	7	2.1

The Measurement Model

The psychometric properties of the measurement model (i.e., convergent validity, composite reliability, and discriminant validity) were analyzed. In Table 3, the AVE of each latent construct was above 0.50. Factor loading of each indicator was statistically significant at $p < 0.001$. Composite reliabilities were at a satisfactorily high level, ranging from 0.892 to 0.942, which have fulfilled the threshold of 0.70 (refer to Table 3). Each latent construct displays good HTMT discriminant validity with values below the 0.90 cut-off value.

The Structural Model

Figure 1 shows that need frustration positively predicts IGD among mobile MOBA players ($\beta = 0.196$, $p < 0.001$), H_1 is supported. For mediating effect, the present study applied the suggestion by Preacher and Hayes (2004, 2008) by bootstrapping the indirect effect. A significant mediation can be concluded if the confidence interval does not contain a 0. As shown in Table 4, skill, escape, coping, competition, and skill development motive significantly mediate the association between need frustration and IGD, H_2, H_3, H_4, H_5, and H_6 are supported. However, fantasy and recreation motives do not significantly mediate need frustration and IGD; hence, H_7 and H_8 are not supported. The explanatory power (also known as in-sample prediction) of the outcome variable—IGD is reported using the coefficient of determination, R^2, and effect size f^2. The R^2 value of IGD is 0.691, signifying 69.1% of the variances are explained. According to Cohen (1988) f^2 effect size's formula ($R^2/1\text{-}R^2$), values greater than 0.02 indicate small, 0.15 as moderate, and 0.35 as large. Using this formula, the IGD construct shows 2.236 of f^2 value, implying a large effect size.

For assessing the out-of-sample predictive power, the Q^2 predict value of the endogenous construct—IGD has to be first examined. It has been found that IGD ($Q^2 = 0.423$) is greater than zero, fulfilling the first criterion. Subsequently, the prediction errors (also known as residuals), IGD construct shows a reasonably symmetrical distribution, which has confirmed the use of root mean squared error (RMSE) statistic in PLSpredict (refer to Fig. 2). As shown in Table 5, a total of three out of nine indicators show RMSE values in PLS smaller than linear model (LM), signifying a small out-of-sample predictive power.

Table 3 Composite reliabilities and average variance extracted

	Composite reliability	Average variance extracted
Social	0.923	0.751
Escape	0.942	0.801
Competition	0.914	0.727
Coping	0.911	0.719
Skill	0.938	0.792
Fantasy	0.895	0.680
Recreation	0.892	0.733
Frustration	0.932	0.547
IGD	0.906	0.549

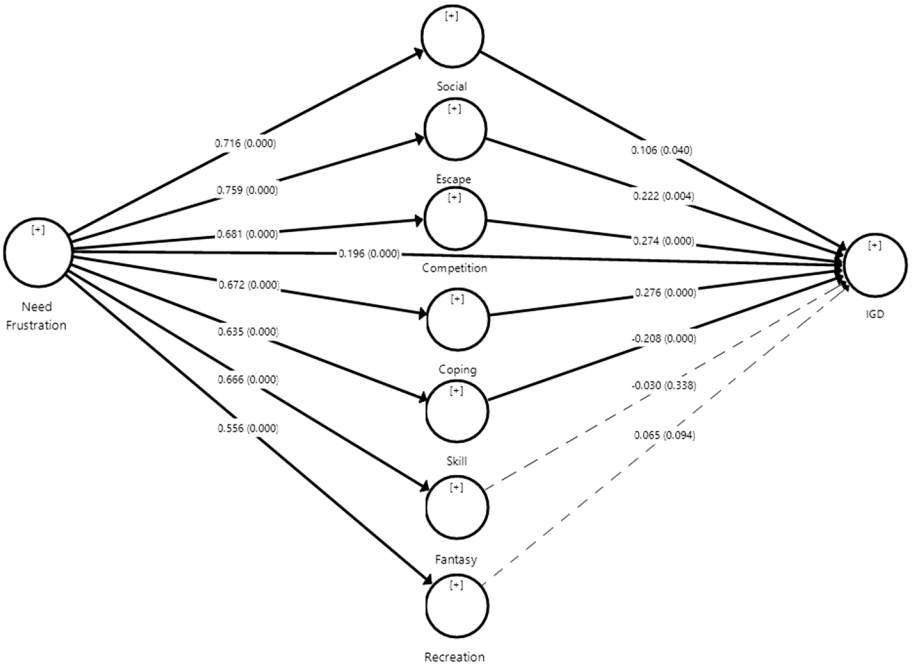


Fig. 1 The structural model. *Note*: The *p* value is in parentheses, and next to it is the standardized path coefficient. A positive path coefficient shows a positive predictive effect on the outcome variable, vice versa. The dashed line reflects a non-significant path, whereas the solid line reflects a significant path

Table 4 The results of mediating effects

Paths	Std beta	*t* value	*p* value	BCI LL	BCI UL
NF Social IGD	0.076	1.712	0.043	0.005	0.153
NF Escape IGD	0.168	2.631	0.004	0.062	0.271
NF Competition IGD	0.187	3.740	0.000	0.105	0.269
NF Coping IGD	0.185	4.361	0.000	0.116	0.254
NF Skill IGD	−0.132	3.444	0.000	−0.195	−0.069
NF Fantasy IGD	0.020	0.413	0.340	−0.097	0.060
NF Recreation IGD	0.036	1.304	0.096	−0.006	0.085

F need frustration; *IGD* Internet gaming disorder; *BCI LL* biased corrected confidence interval (lower level); *BCI UL* biased corrected confidence interval (upper level).

Discussion

The present study examined mobile MOBA players to advance the understanding of IGD through the lenses of preliminary and theoretical conceptualization. Players with stronger need frustration are prone to experience IGD, and the first hypothesis is supported. The finding is consistent with SDT by Ryan et al. (2006), individuals who are struggling to fulfil their basic psychological needs in real-life resort to excessive gameplay. Specifically, SDT needs deficiencies to act as precipitating factors (when these needs are not fulfilled

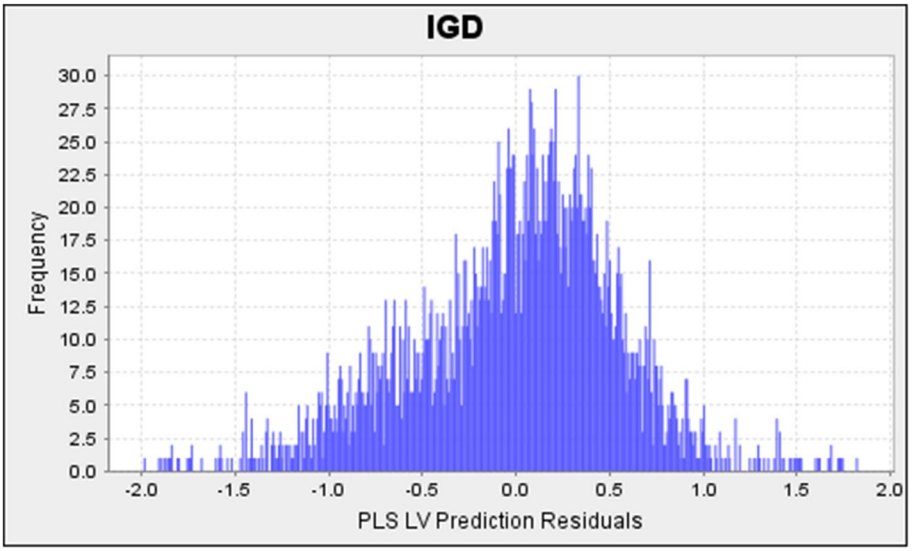


Fig. 2 The distributions of prediction error of the endogenous construct—IGD

Table 5 The comparison between RMSE of PLS and LM in PLSpredict analysis

Indicator	PLS-RMSE	LM-RMSE	PLS-LM RMSE
IGD1	0.912	0.905	0.007
IGD2	**0.912**	**0.923**	**−0.011**
IGD3	0.945	0.941	0.004
IGD4	**0.922**	**0.943**	**−0.021**
IGD5	**1.053**	**1.059**	**−0.006**
IGD6	1.083	1.083	0.000
IGD7	1.112	1.073	0.039
IGD8	0.998	0.981	0.017
IGD9	1.061	1.026	0.035

3 indicators (formatted in boldface) show PLS RMSE smaller than LM RMSE.

in the physical world) and perpetuating IGD factors (when these needs are fulfilled in the virtual gaming world) (Scerri et al., 2019). The situation is expected to worsen when players are forced to act against their will, feel incompetent, and not socially accepted in the real world. Therefore, the likelihood of experiencing IGD or seeking more in-game rewards is intensified (Chamarro et al., 2020). There is no denying that players experience temporary psychological relief through gameplay; however, the unresolved problems in the offline world persist (T'ng & Pau, 2020). When the gaming behavior is repeatedly reinforced, a vicious cycle will be challenging to dispute. IGD may be best described as a maladaptive coping mechanism that permits players to escape from or compensate for problems in everyday lives (Kardefelt-Winther, 2017). Wegmann and Brand (2020) agreed that expectancies play an essential role in forming an addiction. Need frustration leads to increased mobile gaming, particularly when players hold expectations of obtaining instant

gratification. In short, when people are frustrated in real-life, they seek ways to get rid of the frustration.

Despite examining the direct effect, the present study also explored the mediating effect of gaming motives on the association between need frustration and IGD. Overall, social, escape, competition, coping, and skill development motives are significant mediators for need frustration and IGD. However, fantasy and recreation motives are not significant mediators. Players who experience high frustration in daily life (e.g., have stressful social environment or interpersonal relationships) can be easily attracted by the appealing socialization features offered by mobile MOBA games. *Social* motive mediates the association between need frustration and IGD. This can be explained by the extensive social interaction in MOBA online games (cooperative play) strongly reinforces players to be more socially active and encourages them to spend longer time in the gaming world (Blinka & Mikuška, 2014; Zhong & Yao, 2013). Social players also enjoy helping and interacting with other players (in the form of written chat or audio) and actively join in-game communities for the sake of companionship (Caplan et al., 2009). Subsequently, frustrated players with *escape* motive avoid real-life problems, and they choose not to think about them (Demetrovics et al., 2011). Escapism has also been empirically found as a significant mediator between psychological distress and gaming disorder (Bányai et al., 2019b). Notably, Kardefelt-Winther (2014) described that gamers who experienced high levels of stress (closely related to frustration) but had stable well-being and self-esteem did not pathologically use video games even they had a high level of escapism. This signifies that the relationship between escapism and IGD can be influenced by psychological states.

The finding also demonstrates that frustrated players with strong *competition* motives are prone to experience IGD symptoms. Frustrated players face challenges in attaining desired real-life accomplishments. Expectedly, a player's failure in real life can serve as a strong motivator for achieving in-game advancement. There is no denying that player dreams of online achievements can symbolically replace their unattainable offline goals (Snodgrass et al., 2013). The high frustration and strong competition motive drive players to compete with others for reaching a dominant state during gameplay. Players can be easily motivated by "levelling up"—which can always serve as the team's goal, striving for more remarkable performance. This situation is common in MOBA games which require intensive group collaboration (one team combats with another team). Complying to the team's goal could be perceived as a prerequisite for players to continually belong to the team, bringing more difficulties for players to dispute the cycle of gaming addiction. Next, the contribution of negative emotion (e.g., frustration, depression) as an IGD risk factor can be explained in which addiction is exhibited as a maladaptive emotional *coping* strategy (Stavropoulos et al., 2016). Players use video games to experience positive feelings (e.g., a stronger sense of autonomy and being socially accepted). Hence, mobile MOBA games motivate players to be involved in excessive gameplay for draining off the negative feelings derived from the physical world. Generally, excessive gameplay signifies a player's intention to counterbalance real-life disadvantages (Kardefelt-Winther, 2014).

The present study has also discovered a novel finding in which players with *skill* development motive are less likely to experience IGD symptoms (having negative standardized beta). In other words, the skill development motive serves as a protective factor but not a risk factor. Having a high level of skill (e.g., hand–eye coordination, mental skills, attention) is crucial to succeed in the gaming world. The acquired skills serve as a stepping stone to assist players in being more knowledgeable about the game, thinking strategically, making quick and wise decisions (Himmelstein et al., 2017). Expectedly, the learned skills from online games can be transferred into real-life functioning. Consistently, a small but

significant body of research has begun to grow, documenting the mental benefits of video games (contrary to the conventional beliefs that online games are harmful). Past empirical studies reported the mental benefits of gaming, such as spatial skill improvement (Green & Bavelier, 2012), more effective allocation of attentional resources (Bavelier et al., 2012; Qiu et al., 2018), better problem-solving skills (Adachi & Willoughby, 2013), and enhanced creativity (Jackson et al., 2012). The improved mental skills might function as protective factors to prevent players from being trapped in the vicious cycle of gaming addiction. They might be good at managing their life obligations without sacrificing their time spent in gameplay. It can also be explained that moderate play promotes flourishing mental health more than excessive play or lack of play (Jones et al., 2014).

The non-significant mediating effect of *fantasy* motive on need frustration and IGD can be explained by the differences of features' complexity between mobile and computer MOBA games. The limited features of mobile MOBA games might restrict players from immersing themselves in the constructed fantasy world. The customization of avatars might not be as rich as personal computer MOBA games. Mobile MOBA games are compulsory to be played in a team, emphasizing group collaboration and coordination. However, pursuing a fantasy goal might be more common at an individual level, specifically games which can be played solo (e.g., massively multiplayer online role-playing game, MMORPG). Generally, it is plausible that this fantasy motive is less dominant in mobile MOBA games, explaining the non-significant finding. Lastly, *recreation* motive is also not a significant mediator for need frustration and IGD in the present study. It is postulated that frustrated players with recreational motive use online games merely for enjoyment and relaxation. The gameplay is not necessarily goal-driven, but merely for pleasure. Entertainment players choose gameplay without anticipating any rewards. They might not value achievements, or virtual wealth and prestige gained. They might also have distinguished game and real-life rationally, therefore not significantly affected by gaming addiction (Zhong & Yao, 2013). However, these preliminary findings have to be interpreted with caution, and more studies are required for further confirmation.

Implication

In light of the aforementioned findings, negative outcomes of online gaming are repeatedly mentioned. However, it is important to take note that players have diverse motives and they use gameplay to satisfy various needs. Despite the risk of excessive gaming, scholars have to consider that these gaming applications to some extent have satisfied basic human needs (e.g., autonomy, competence, and relatedness). The findings of the present study contribute to the growth of IGD's literature, particularly in the context of mobile MOBA games. The in-sample large Cohen's effect size signifies the appropriateness of the selected key variables. Although the out-sample shows a small predictive effect, there are various gaming genres, hence contributing a restricted form of generalizability of findings. The examination of the key variables is essential not only in this specific research area but also in mental health practice and policymaking.

Early detection from various parties is crucial for reducing the detrimental impacts of IGD. Therefore, prevention and intervention should be highly valued. It is believed that school-based prevention programs (including high school and university) are beneficial. Students should be given high accessibility to healthcare services without having additional effort to seek professional contact. Relevant authorities are encouraged to implant essential knowledge and skill for students to cope with frustration in daily life. The learned skills

can directly and indirectly reduce their vulnerability even after the completion of the study. Prevention aims to reduce the manifestation of IGD; however, intervention addresses players who have exhibited IGD symptoms. A greater emphasis should be placed on youth's coping mechanisms while dealing with life events. It is believed that the addictive use of mobile games serves as a dysfunctional coping mechanism. Addicted youth players are encouraged to cultivate healthier leisure activities to reduce gaming time in general. Mental health practitioners may guide disordered or high-risk players to acquire the skill to appraise their experienced symptoms, seek alternative solutions, evaluate solutions, and make a rational decision. Practitioners also play an essential role in guiding them to identify any unfavorable cognitions, for enhancing the treatment success rate. More evidence-based emotional regulation strategies can also be introduced for players to cope with unpleasant emotions, striving to reach a good emotional-controlled state. At the level of policymakers, implementation of a strong policy is perceived as of utmost importance given that the policy brings significant impact to the entire nation. Policymakers are encouraged to work intensely with mental health practitioners, educators, and parents to gain more useful information about youth's online gaming behavioral patterns. Underaged players should be closely monitored and restricted for excessive time spent on online games. If the time has exceeded, the skill points (or any in-game rewards) should be gradually decreased and eventually deactivated. The main purpose of adopting this system is to reduce positive reinforcement from online gaming.

Limitation, Recommendation, and Conclusion

Several limitations of the present study should be noted while interpreting the findings. First, the study was conducted using a cross-sectional survey, restricting a wider understanding of the development of IGD. Future studies are encouraged to apply longitudinal studies and combine several data collection methods (e.g., interview, experiment, and case study). The present study also adopted a nonrandom sampling method due to the lack of sampling frames. Future researchers are encouraged to obtain a sampling frame and apply random sampling to reduce sampling bias and error. The participants of this study aged between 18 and 29. Therefore, the findings might not be applicable for other age groups. It is highly recommended to widen the age range for a clearer comparison between groups. In conclusion, it would be unrealistic for high-risk gamers to abstain from online gameplay fully. It would be more realistic for cultivating positive characteristics, such as stronger self-control, social competence, and positive self-concept. By strengthening these personal qualities, youth players acquire stronger mental strength to reduce the "push" effect and actively cope with life challenges.

Author contribution T'ng assisted with literature search, study design and concept, statistical analyses, data interpretation, generation of the initial draft of the manuscript, manuscript preparation and final editing; Ho assisted with data collection, generation of the initial draft of the manuscript, manuscript preparation, and final editing; Pau assisted with manuscript preparation and final editing.

Declarations

Ethics Approval The ethical approval was issued by the Scientific and Ethical Review Committee from the main author's university.

Informed Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants included in the study.

Conflict of Interest The authors declare no competing interests.

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