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Is Online Gaming Associated with Problem Gambling and Problem Gambling Risk Factors? An Exploratory Study in a Sample of University Undergraduates

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ABSTRACT

This project comprises two studies examining connections between problem online gaming and problem gambling in a sample of university undergraduate students. Study 1 validates a modified version of the Problem Video Game Playing Test (PVGT) as a measurement tool for measuring problem online gaming. PVGT scores were then regressed on a number of risk and protective factors theorized to be common to problem gambling and online gaming. There was no multivariate evidence of connections between problem gaming and concepts traditionally explored in problem gambling literature, such as mental health, life satisfaction, impulsiveness, and self esteem. Motivations for online gaming were among the strongest predictors of PVGT (with the exception of the fantasy and skill development motivational factors), suggesting highly motivated gamers were more likely to play at problematic levels than those less motivated. Although the theorized relationships between problem gaming and various risk factors, including problem gambling, were not evident in the general student sample, it was hypothesized that perhaps only certain subgroups of gamers may exhibit some risk factors such as high prevalence of mood disorder or low mental health. To assess this possibility, in Study 2, we conducted a latent class analysis of online gamers and found three distinct sub-classes: a group of extensive or cross-platform “gambling gamers” (2.9%), a group of primarily “free-to-play” gamers (22.4%) and the majority group of “casual/non-free-to-play” gamers (74.7%). The gambling gamer class was distinguished by higher scores for problem video gaming, and membership in this class was heavily predicted by problem gambling. Future research should investigate these connections with larger samples of online gamers using repeated measures over time to detect movement between classes and temporal ordering in relationships between classes and purported risks and protective factors.

KEYWORDS: Problem online gaming, problem gambling, risk/protective factors, university students, latent class analysis

Introduction

Recent years have witnessed a massive expansion of online gaming and growing convergence of online social/video gaming with online gambling in terms of the structure and style of games—non-gambling games are increasingly building in gambling-like features—as well as the cross-marketing and consolidation of gambling/gaming site operators (Morgan Stanley, 2012). Given their high levels of involvement with social media, youth and young adults may be particularly vulnerable to increasing exposure to online gaming and its convergence with online gambling (Derevensky et al., 2013; Derevensky and Gainsbury, 2016). Games on social media attract a variety of gamers due to the vast amount of game types they offer, including gambling-type games (Derevensky and Gainsbury, 2016). Primary concerns include whether increasing incorporation of gambling-like features into non-gambling online games increases youths' receptivity to and interest in gambling, and whether social-media gambling-style games present a gateway to more potentially harmful real money gambling sites and associated gambling-related problems. Youth and young adult social gamers who experience success on gambling-style social media (free to play) games may migrate to real money gambling sites. Typically the odds of winning in free gambling-style games are much better than in real money gambling sites, so players have unrealistic expectations regarding their skills, chances, and costs in real money gambling.

In light of this, there has been growing research into social online gaming and its relationship to gambling behavior and problem gambling risk (Derevensky et al., 2013; King, Delfabbro, & Griffiths, 2013). Our research proposed to address two of MGRP's 2014 research priorities (10 & 11): Does participation in certain types of online gaming present a new and growing risk factor for development of problem gambling in young adults? Are there certain characteristics and experiences of online gaming that are associated with different patterns of gambling activity and risk level? And are there common etiological associations (e.g. mental health and substance abuse comorbidities, motivations, coping, etc.) between online gaming and gambling behaviour, and between problematic/pathological online gaming and problem gambling? Although primarily exploratory and descriptive in scope, given the relatively nascent stage of research in this area, our two-part study sought to gather new insight into possible connections between online gaming and gambling behavior and problem gambling risk.

Study 1 of this project investigates the validity of a modified version of the Problem Video Game Playing Test (PVGT) as a measurement tool for determining an individual's problem online gaming status. This involves several steps; first, will be a partial replication of the original PVGT validation study (King et al., 2011), including assessing the psychometric properties of the PVGT, followed, second, by a test of its convergent validity with several theoretically related concepts. In the third step, if the evidence indicates the PVGT is a valid and reliable measure of problem online gaming, additional hypotheses pertaining to the theorized relationships between problem video gaming and several other behaviours and motivations will be assessed. In Study 2 of this project, we will further examine the connections between online gaming and gambling by conducting a latent class analysis of online gamers to (a) determine if there are distinct classes of online gamers based on gaming activities and preferences, and (b) whether hypothesized risk and protective factors, including problem gambling, help distinguish between different classes of online gamer.

Rationale and Literature Review

Rising prevalence of online gaming

The market for online games has expanded significantly over the past two decades, alongside the development of the internet. As the market has expanded, so too has the number of gamers and the amount of time they spend playing video games (NPD Group, 2013). According to the Entertainment Software Association (2016), sixty-three percent of American households have at least one person who plays games for at least 3 hours a week on average, and forty-eight percent of households own a video game console. Heavy video gamers are typically adult males between the ages of twenty-five and thirty, who play video games for approximately eight hours per week (King et al., 2013). For this group, video gaming is typically a long standing (about ten years on average) recreational pastime. For the vast majority of individuals online gaming constitutes a form of recreational entertainment; however, there is a growing concern surrounding problematic video game playing. While empirical research into problematic video gaming remains limited, estimates suggests that addictive video game symptoms may be as high as two percent in some communities, and potentially as high as fifteen percent among university aged students who play primarily online games (King et al., 2013, p. 821).

Video-gaming is no longer a primarily male activity, although the demographic characteristics for males and females that game are quite different. Recent data from the Entertainment Software Association (2016) shows that the average age of female gamers is forty-four, whereas for males it is thirty-five. The expansion of online social and mobile games partly accounts for this difference, as these “casual” types of games typically attract a female audience (King et al., 2013, p. 822). Additionally, online puzzle and mobile games, in addition to “online multiuser” games, are more popular with individuals over the age of 35, which accounts for fifty percent of female gamers (Entertainment Software Association, 2016; King et al., 2013, p. 822). However, males are far more likely than females to play video games as children and young adults, and males’ gaming sessions tend to be substantially longer than females’ gaming sessions (King et al., 2013). Although males tend to be heavier video game players than females (Colwell & Kato, 2003), women tend to be at a higher risk of pathological internet use due to their greater interactions with social media/networking and “online shopping” (King et al., 2013, p. 822).

With the expansion of the internet, there has been an increase in social video gaming, as players utilize “structural elements” (King et al., 2013, p. 823) present in online games, such as communications and rewards systems, which encourage players to interact with one another in “shared virtual worlds” (Przybylski, Rigby, & Ryan 2010, p. 156). Social media games have expanded to include a significant number of players across many types of games, including gambling-themed games (Derevensky and Gainsbury, 2016). Among heavy gamers, almost fifty percent report playing games that fit into a social category, and fifty-four percent report playing games with friends and/or family members (Entertainment Software Association, 2016). In fact, fifty-three percent of frequent video gamers report playing video games as a way of interacting with friends. Furthermore, many parents report playing video games with their children because it allows them to socially interact with their child. Video gaming is not an isolated form of entertainment as more users play video games as a source of social connectedness.

Similarities between online video game playing and gambling

Modern video games share many “structural” similarities with gambling systems (McBride & Derevensky, 2016; King et al., 2013; Delfabbro et al., 2009, p. 393). For example, “social casino

games" share many characteristics with "online gambling" games (Kim, Wohl, Gupta, & Derevensky, 2016, p. 116). Indeed, the earliest video games were "conceptualized as a nonfinancial form of gambling" due to the similarities they share with gambling systems (King et al., 2013, p. 822). For example, physical characteristics, such as user interfaces, sounds, graphical designs and effects and intermittent reward systems are similar in both video and gambling machines (King et al., 2013; Delfabbro et al., 2009). This is because video games and gambling systems both attempt to grab and maintain the attention of the user. Importantly, video gamers and gamblers both share a common "playing philosophy", which is to play "for as long as possible without losing" (Delfabbro et al., 2009, p. 393). In this way, video game and gambling systems attempt to use physical elements that enhance and promote this philosophy to encourage the user's absorption in the activity.

Problem Gambling

Disordered gambling has been the subject of research since it was first described as "gambling mania" in the late nineteenth century (Black & Moyer, 1998, p. 1434). Importantly, problem gambling is not necessarily pathological in nature. Problem gambling refers to the "urges" to gamble that an individual might experience, despite the potential negative impact it can have, whereas pathological gambling applies the understanding of "true compulsions in the clinical sense of the word" to gambling activities (Jazaeri & Bin Habil, 2012, p. 6). Due to these differences, many individuals prefer to use the term problem to describe addictive gambling and the associated consequences, since pathological gambling only describes the most "extreme cases of problem gambling" (Jazaeri & Bin Habil, 2012, p. 6). Pathological gambling was not considered a medical problem, however, until its inclusion in the DSM-3 in 1980 (Black & Moyer, 1998). By this time methods of gambling were expanding, as were the number of places to gamble and the amount of money individuals were gambling with (Martin, 2008; Black & Moyer, 1998). In 1998, the prevalence of problem gambling was as high as one and a half percent of the total United States population, and while it remains most prevalent among the male population, its rate of growth had been greater among women (Black & Moyer, 1998). In Canada, research suggested that over one million Canadians were at risk of becoming problem gamblers by the year 2002 (Martin, 2008). Recent statistics suggest that the Canadian prevalence rate of problem gambling is 0.9 percent, while 2.6 percent of gamblers are at risk of developing problem gambling (Responsible Gambling Council, 2015).

There is evidence pointing to the comorbidity of problem gambling with several "mood disorders" including anxiety, depression, distress, and elevated levels of dissociation (Blaszczynski & Nower 2002, p. 489-490). Mood disorders are more prevalent among problem gamblers when compared with non-gambling populations (Martin 2008; Black & Moyer 1998; Becona et al., 1996). While male problem gamblers tend to exhibit higher levels of depressive symptoms than females, depression remains a "common co-morbid condition found among pathological gamblers" (Blaszczynski & Nower, 2002, p. 490). However, Blaszczynski and Nower (2002) found that anxiety and dissociation were strong predictors for male pathological gambling whereas depression and dissociation were stronger in predicting female problem gambling.

Interestingly, boredom plays a role in pathological gambling as well. For many pathological gamblers, gambling is perceived as an act that reduces boredom (Blaszczynski & Nower, 2002; McCormick, 1994). Pathological gamblers often find themselves bored during repetitive gambling acts, and require additional stimulus to alleviate boredom. Defined as "action-seekers", this group of problem gamblers are considered thrill seekers who make gambling exciting through competitive skill-based gambling, and/or by chasing "big payoffs", and have a

desire to “impress” (Blaszczynski & Nower 2002, p. 490). Thus, competition and a desire for social status contribute to pathological gambling behaviour.

As the internet continues to grow, there has been a significant increase in online gambling activities. Griffiths and Kuss (2015) found that the majority of individuals who gamble online also gambled offline, suggesting that online gamblers do not restrict their behaviour to the internet form of gambling. Interestingly, and although the percentage of players who could be classified as online-only gamblers was small, Griffiths and Kuss (2015, p. 387) state that there was “not a single case of problem or pathological gambling among those gamblers who only gambled online”. However, the authors suggest caution when interpreting this result as the sample size for this online-only gambling category was small. They suggest that perhaps individuals who gamble exclusively online may be resistant to certain factors that contribute to problematic gambling behaviour, although more research into this finding is necessary.

Problem Gaming and Problem Gambling—Common Risk Factors?

There is rising concern over whether problem online video gaming may constitute a pathway towards future gambling addiction (King, Delfabbro, & Zajac, 2011). Indeed, the gambling industry has recognized the value of tapping into the market of video game consumers. In Nevada, for example, new legislation encourages gaming manufacturers to develop skill-based gambling systems that will target a younger generation of technically savvy individuals (St. Martin, 2015). Consequently, the potential link between problematic video gaming and problematic gambling compels further research to help illuminate risks that may exacerbate vulnerability to developing problematic gambling behaviours.

While the connection between problem video gaming and problem gambling is often viewed as tenuous, there is a significant body of research that suggests certain risk factors are common to each disorder (McBride & Derevensky, 2016). For example, factors such as anxiety and depression are common risk factors for developing gambling addiction and video game addiction (Delfabbro & King, 2015). Additionally, concepts that are often associated with diagnostic criteria for gambling disorder are present in research that attempts to outline a conceptualization of video game addiction (Petry, Rehbein, Ko, & O’Brien, 2015; Petry et al., 2014; King et al., 2013.) Motivations to gamble, such as coping with mood disorders or mental illness, stress, and escaping from reality or life problems, are also found in models that relate to video game play (Sim, Gentile, Bricolo, Serpelloni, & Gulamoydeen, 2012). Another risk factor for developing future gambling problems is associated with playing “social casino games” online and through “social networking sites” (Hollingshead, Kim, Wohl, & Derevensky, 2016, p. 53). Importantly, studies have suggested that the younger an individual is when exposed to gambling-themed gaming, the greater risk they are for developing future gambling problems (Derevensky and Gainsbury, 2016). Finally, there is evidence to suggest that pathological gamblers also display addictive elements when playing video games, such as playing for excessive lengths of time (Sim et al., 2012).

Importantly, the fifth revision of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) includes “Internet gaming disorder” as a subject for further study (Petry et al., 2015, p. 1). Interestingly, while some measures of addictive video game playing are adapted from research into the subject of internet addiction, the condition of internet addiction is not included within the DSM-5. Compulsive gaming is seen to have more significant detrimental effects for individuals than internet addiction (Petry et al., 2015). Ultimately, the DSM-5 deems that more research into pathological gaming and accurate diagnostic tools are necessary before internet gaming disorder can be fully classified as a “mental disorder” (Petry et al., 2015, p. 2).

When examining the clinical treatment of problem gambling and video gaming, Delfabbro and King (2015, p. 316) find that “dysfunctional beliefs”, misperceptions related to winning odds, probability, and the “illusion of control”, lead to an individual’s inability to evaluate gambling outcomes. This issue becomes problematic in relation to the introduction of skill-based gambling systems, where, as the name suggests, consumers are encouraged to believe that their level of skill can directly impact their gambling outcomes.

Two significant factors that have been identified in their relationship to problem video gaming and gambling are depression and anxiety (Delfabbro & King, 2015). Factors such as depression and anxiety have a higher prevalence among problem gamblers when compared to non-gamblers (Martin, 2008; Black & Moyer, 1998; Becona, Lorenzo, & Fuentes, 1996). Additionally, gambling might be used as a form of coping and escape by individuals who experience conditions like depression or anxiety, as it can provide a temporary escape from reality and acts like a distraction from other problems (Gambling Treatment Helpline, 2015; Blaszczynski & Nower, 2002). These risk factors for problematic gambling, in addition to other factors such as escapism and coping, are shared with problematic video-gaming (Sim et al., 2012). Sim and colleagues (2012, p. 751) also suggest that problem gamblers are far more likely to invest “excessive amounts of time playing video games”.

It is important to analyze concepts that are frequently discussed in terms of gambling addiction in their relationship to problem online gaming. Impulsivity, for example, is often associated with antisocial personality disorder and psychopathy, which are also linked to addictive gambling (Blaszczynski, Steel, & McConaghy, 1997, p. 85). Impulsiveness in pathological gambling research refers to acts which stem from a compulsive drive to gamble, which may include how individuals procure gambling funds (Blaszczynski & Nower, 2002; Blaszczynski et al., 1997). Thus, it is important to explore impulsivity as it relates to problem online video gaming.

Other important links have also been drawn between problematic video gaming behaviour and problem gambling. In a simulation experiment that compared interactions between online gaming and risky behaviour in real-money gambling, Frahn, Delfabbro and King (2015, p. 1539) found that youth between the ages of eighteen and twenty-four, who had been exposed to free-play gambling modes that featured a “practice gambling” mode, were more likely to participate in risky gambling behaviour than those who interacted with a system without a “demo” mode. The results of this study suggest that individuals who interact with online game systems that simulate a gambling environment (alongside a significant reward system) may be at a higher risk for problematic gambling behaviour. Although the online game users interacted with was a gambling simulation video game, the results of this study have important implications for the relationship between video gaming and gambling.

The development and expansion of choice within video games and the development of “equifinality” (multiple paths to the same end) in video games has contributed to an increased sense of “autonomy” for gamers by offering them control over “multiple game elements” (Przybylski et al., 2010, p. 156). By making the developmental choice to include multiple options and pathways through a video game, players are able to interact with the game as a context with seemingly limitless possibilities. Massively multiplayer games, while often containing story driven content, are also a source of varied and diverse experiences as players contribute to and determine manners of playing and interacting with the game (Przybylski et al., 2010). Thus, where one player may enjoy playing through the story of a game and completing their journey in a period of hours, another player may spend weeks or months exploring the game world and participating in events not directly related to story content. This further opens avenues for community driven events and social interaction within the framework of the game.

Importantly, researchers have began exploring what factors motivate individuals to play video games. Hollingshead and colleagues (2016, p. 55) noted that, among other factors, individuals are motivated to play social media gambling-themed games through a motivation for excitement or to "help them contend with … daily life problems". Furthermore, individuals may seek to develop their skills in free-to-play games before attempting real money gambling games (Hollingshead et al., 2016; Kim et al., 2016; Kim, Wohl, Salmon, Gupta, & Derevensky, 2015). Demetrovics and colleagues (2011) suggest that video game playing should be understood as an activity that shares similarities with alcohol consumption, where motivational factors impact alcohol use. However, while problematic video gaming outcomes occur, there is evidence to suggest that video gaming occurs through an array of motivations that "satisfies various real needs", and outcomes are not always negative (Demetrovics et al., 2011, p. 823). Through a review of the literature on video gaming, and by interacting with members of the online gaming community, Demetrovics and colleagues (2011, p. 816) initially identified seven categories of motivations related to video gaming: "coping-escape, fantasy, skill development, omnipotence (power), recreation, competition, and social motives". Further analysis resulted in the elimination of the omnipotence (power) category, and provided evidence to suggest that a separate coping and escape factor existed. Many of these factors are shared with gambling motivations, such as social connectedness, fun/recreation, and escaping negative feelings, for example (Hollingshead et al., 2016). Therefore, a final seven item questionnaire was formed with seven factors which are labelled coping, escape, fantasy, skill development, recreation, competition, and social (Demetrovics et al., 2011).

Another concept which has been explored in problem online gaming research is 'social connectedness'. Video gaming has become an increasingly social pastime, with many digital gamers participating in "social gaming" (Domahidi, Festl, & Quandt, 2014, p. 107). This desire to social connectedness is also viewed as a motivational factor for gambling (Hollingshead et al., 2016). Video gamers have historically been treated as socially isolated individuals, and even when relationships are formed through interactions within a digital world, they are frequently viewed as less meaningful than real-world friendships, termed "auxiliary relationships" (Domahidi et al., 2014, 108). Some researchers point out that many digital interactions require participating in an activity together, but with minimal interaction (Domahidi et al., 2014; Ducheneaut, Yee, Nickell, & Moore, 2006). Thus, social alienation is an important concept related to online video gaming.

Additionally, self-esteem is a concept that has led to mixed conclusions for researchers who study problem online video gaming. Colwell and Kato (2003) state that while some studies have shown that self-esteem is negatively linked to video game play, others have found no such relationship. This may be due to the different measures used by researchers exploring self-esteem in video gaming, and thus makes comparisons between studies difficult.

Finally, overall life satisfaction and well-being are seen as being negatively associated with excessive video game playing (Lemmens, Valkenburg, & Peter, 2009). In fact, one reason individuals may seek out video games is because they have the potential to "enhance … short-term well-being" (Przybylski et al., 2010, p. 157). It is important to note, however, that addictive video gaming overall has a negative effect on "psychological well-being" (King et al., 2013, p. 820). Video games are thus used as a means of escaping or coping with low life satisfaction and well-being (Lemmens et al., 2009). Although online video gaming may begin as a means of alleviating an individual's lowered levels of life satisfaction and well-being, excessive participation ultimately has detrimental effects for the addicted video gamer.

STUDY 1

There are multiple ways that researchers have tried to assess addictive and/or problematic behaviours related to video games. While research into problematic video gaming has historically focused on the length of time individuals spend playing video games, increasingly researchers have begun to focus on the addictive behaviours exhibited by video gamers (Kaptsis, King, Delfabbro, & Gradisar, 2016; King et al., 2011; Lemmens et al., 2009). In fact, the inclusion of Internet Gaming Disorder (IGD) in the appendix of the DSM-5, suggests heightened recognition of "gaming as an addictive behaviour" (Kaptsis et al., 2016, p. 59). Several different measures exist which attempt to assess problematic video gaming behaviour, including the Game Addiction Scale and the Problem Video Game Test.

Importantly, there has been a lack of agreement about the conceptualization of what exactly constitutes "game addiction" (Lemmens et al., 2009, p. 78, Griffiths et al., 2016). Lemmens and colleagues (2009, p. 78) discuss how previous research has used the terms "pathological gaming" and "dependence" to describe problematic video gaming behaviour. Ultimately, Lemmens and colleagues (2009, p. 78) state that video game addiction should be defined "as excessive and compulsive use of computer or videogames that results in social and/or emotional problems; the gamer is unable to control this excessive use". Video game addiction therefore is related to loss of control and compulsive behaviour, elements that also form the DSM criteria for gambling addiction (King et al., 2013; Lemmens et al., 2009). More recently, researchers have focused on "Internet Gaming Disorder (IGD)", and since IGD remains listed as a subject in need of further study in the DSM-V, there is still lack of scholarly consensus about assessing IGD (Griffiths et al., 2016, p. 2).

King and colleagues (2011) proposed the use of the Problem Video Game Playing Test (PVGT) to analyze a general problematic form of video game playing. In contrast to indices designed to measure pathological or addictive video gaming (such as the Online Game Addiction Index and the IGD-20; Zhou & Li, 2009; Pontes et al., 2014), the PVGT measures a general concept of "problem play" related to video games (King et al., 2011, p. 84). Hence, the PVGT measures "problematic involvement with video games" while including aspects related to the "components model of addiction" (King et al., 2011, p. 77-79). The PVGT is a gaming-adapted version of the Internet Addiction Test (IAT), a twenty-item questionnaire that assessed one's problematic or potentially addictive internet use (Young, 1998; King et al., 2011). By substituting the words "video game(s)" in place of "internet" in the questionnaire, and adjusting the questions slightly for grammatical sense, King and colleagues (2011, p. 77) created a survey aimed at assessing addictive traits in video gaming behaviour. The PVGT thus asks questions related to "conflict, preoccupation, tolerance, and lack of control" while containing "many of the same aspects of addictive behaviour covered within the DSM-IV criteria for Pathological Gambling" (King et al., 2011, p. 77).

The PVGT is potentially the most rigorous assessment of problematic video gaming among youth and young adults. Factor analyses alongside structural equation modelling have suggested that the PVGT measures a single concept, labelled problem video gaming, and it has displayed very high internal consistency in its two preliminary examination studies (Cronbach's alpha = 0.93 and 0.92 respectively) that were conducted among 373 South Australian university students and 416 individuals recruited from video game outlets and internet cafes (King et al., 2011). An exploration of the PVGT's construct validity revealed that it correlated well with factors expected to associate with problem video gaming, including measures for time spent

playing, depression, anxiety and stress. Thus, the PVGT remains promising in its ability to measure problem video game playing. This study will further investigate the measurement quality of the PVGT by assessing its psychometric properties with a sample of Canadian undergraduate university students.

Research Questions and Hypotheses

In addition to determining the internal structural validity of the Problem Video Game Test index, study 1 examines the PVGT's convergent validity by utilizing measures that explore concepts previously analyzed in the PVGT's preliminary validation study (King et al., 2011). The first, second and third hypotheses address these items used in assessing PVGT construct validity. If the evidence supports the measurement quality of the PVGT, then, guided by previous research, self-determination theory, and concepts related to the cognitive-behavioural model, hypotheses three through ten examine additional relationships between concepts theoretically linked to problem gambling, and problem video gaming, as measured by the PVGT.

Replication of Convergent Validity Hypotheses

Hypothesis 1. Individuals with pathological behaviours, such as pathological gambling, have higher associations with anxiety and depression than individuals who do not exhibit pathological behaviour (Martin, 2008; Blaszczynski & Nower, 2002; Black & Moyer, 1998; Becona, Lorenzo, & Fuentes, 1996). First, in their original article introducing the PVGT, King and colleagues (2011) found that anxiety measures had a positive correlation to problematic video gaming behaviour. Secondly, King and colleagues (2011) found that higher reported scores on depression measures were related to higher scores on the PVGT. Individuals may participate in activities such as gambling or video gaming as a means of reducing the negative feelings associated with depression or anxiety. Accordingly, it is expected that depression and anxiety will be positively associated with problem video gaming, that is, *individuals who score high on depression and/or anxiety measures will also score high on the Problem Video Game Playing Test (PVGT).*

Hypothesis 2. King and colleagues (2011) found that individuals who reported higher psychological distress were also more likely to display problematic video game playing. Along with measures for anxiety and depression, stress was also assessed in King and colleagues PVGT preliminary validation study, and found to be weakly but positively associated with PVGT scores. Therefore, it is expected that *individuals who report a high degree of perceived stress will score high on the PVGT.*

Hypothesis 3. The amount of time an individual has spent playing video games has previously been investigated as a symptom of problem video gaming (King et al., 2013). The time one spends gaming is often viewed as coming at the cost of social connections, or other such "sacrifices" (King et al., 2011, p. 84; Colwell & Kato, 2003). Additionally, individuals who are problem gamblers are also prone to spending significant lengths of time playing video games (Sim et al., 2012). Since "heavier" players are the focus of the Problem Video Game Playing Test, and "excessive" play "is more or less linearly related to time spent involved in the activity" (King et al., 2011, p. 84). It is expected that *the average length of video game time spent in a typical week will be positively associated with the PVGT scores.*

Additional Hypotheses

Hypothesis 4. Impulsiveness is conceptualized as a disposition that places individuals at risk for becoming a pathological gambler (Blaszczynski et al., 1997; Blaszczynski & Nower, 2002). Impulsiveness is frequently a characteristic associated with problematic gambling, and therefore it is important to include an impulsiveness measure to assess its relationship to problematic video gaming. Although a similar link between impulsiveness and pathological video gaming has yet to be demonstrated, in the present study it is expected that impulsiveness will be positively associated with problematic online gaming, that is, *individuals who score high for impulsiveness will also score high on the PVGT.*

Hypothesis 5. The role of self-esteem in video gaming is a subject of debate, and, to date, studies have shown little to no relationship between problem video gaming and self-esteem (Colwell & Kato, 2003). However, there is a good theoretical basis for thinking self-esteem is negatively correlated with video game playing, and previous research may have reached differing conclusions as a result of using different self-esteem measures (Colwell & Kato, 2003). Therefore, it is expected that self esteem will be negatively associated with problematic online gaming, that is, *individuals who have low self-esteem scores will also score high on the PVGT.*

Hypothesis 6. Pathological video gaming has a negative impact on psychological well-being (King et al., 2013). Addicted video gamers may seek out video games as a way of enhancing short-term well-being (Przybylski et al., 2010). Video games are often seen as a way of coping with low life satisfaction and well-being and may initially be used as a means of alleviating feelings associated with low life satisfaction and well-being (Lemmens et al., 2009). Thus, it is expected that life satisfaction and mental health will be be negatively associated with problematic online gaming, *that is, scores on (a) the life satisfaction scale and (b) the positive mental health continuum scale will be negatively associated with PVGT scores.*

Hypothesis 7. There is evidence that individuals who are considered addicted to the internet exhibit higher levels of loneliness than those who are not (Lemmens et al., 2009). Researchers frequently describe video gamers as socially isolated, with playing video games taking precedence over forming real-world friendships (Domahidi et al., 2014; Colwell & Kato 2003). Therefore, it is expected that social alienation will be positively associated with problematic online gaming, that is, *individuals who score high on social alienation will also score high on the PVGT.*

Hypothesis 8. There are several motivational factors that are said to be associated with video gaming. Social, Escape, Competition, Coping, Recreation, Skill Development, and Fantasy motivations have been discussed as being key elements that motivate players to play video games (Demetrovics et al., 2011). Additionally, aspects related to these motivational factors, which include mastery of control among others, play a role in ensuring the continuance of play (Przybylski et al., 2010). Therefore, it is expected that those with higher levels of gaming motivation will be at higher risk for problematic online gaming, that *is high scores on each video gaming motivational factor will be positively associated with PVGT scores.*

Hypothesis 9. Importantly, males are more often pathological gamblers, and are heavier video game players (Colwell & Kato, 2003; Black & Moyer, 1998). In their original study using the PVGT, King and colleagues (2011) found that males were more likely than females to be problematic video gamers (score high on the PVGT). Thus, it is expected that males will be more likely then females to be problematic video game players, and thus that *male PVGT scores will, on average, be significantly higher than female PVGT scores.*

Hypothesis 10. While the link between pathological gambling and pathological video-gaming is still a subject of debate, there exist many similarities between risk factors for problem

video gaming and problem gambling (King et al., 2013; Delfabbro et al., 2009, Lemmens at al., 2009). Accordingly, it is expected that *individuals who score high on the Problem Gambling Severity Index will also score high on the PVGT.*

Method

This study utilized quantitative methodology, and the data set selected for analysis is the Student Leisure and Well-Being Survey (SLWBS). The SLWBS, approved by the University of Manitoba's Psychology/Sociology Research Ethics Board, was conducted among University of Manitoba undergraduate students enrolled in introductory level Sociology courses. Data collection took place between September 2014 and December 2015. Data collection was the responsibility of Research Assistants who administered the survey in both campus and online classrooms. In total, 1,352 (492 male, 872 female, 8 unstated) students completed the SLWBS in either its pencil and paper or digital format.

The SLWBS sample compares well to available institutional demographics for 2014 to 2015 (provided by the Office of Institutional Analysis at the University of Manitoba). The sample has slightly more female students (65.0%) than are found in the university population overall (54.0%). However, as noted in an institutional report on the Faculty of Arts, female university students were more likely than male students to be enrolled in sociology courses, and to major in sociology. A similar percentage of participants in the sample identified as full-time and part-time university students (82.6% vs. 17.4%), compared to the actual institutional distribution (88.4% vs. 11.6%). Further, the ratio of international to Canadian students (15.4% vs. 84.6%) is nearly identical to institutional demographics (15.1% vs. 84.9%). Finally, 88.7% of participants were aged 18 to 24, which is comparable to the institutional proportion (77.3%). In sum, the characteristics of the SLWBS sample appear reasonably representative of the general university population.

Missing values were assessed for randomness through an analysis of missing values patterns, and Little' MCAR test (0.057, $p<.05$). Thus, there was evidence that data was missing at random, and multiple imputation was applied in order to maintain the maximum number of respondents from the sample.

Measures

Descriptive statistics for continuous variables are reported in Table 1 in the Appendix.

Problem video game playing test. The Problem Video Game Playing Test (PVGT) index is a video-game adapted version of Young's (1998) Internet Addiction Test. In addition to some smaller edits to each of the questions in the index, King and colleagues (2011) replaced each instance of the word "internet" with the words "video game." Thus, the PVGT is a twenty-item scale that was proposed as an improvement over previous measures of problematic video game playing because it utilizes questions adapted by the DSM-IV criteria for gambling addiction. Additionally, questions in the PVGT address the six criteria proposed by Griffiths (2008) for gaming addiction, which include salience, mood modification, tolerance, withdrawal, conflict, and relapse. Importantly, the SLWBS further modified questions in the PVGT to specifically address online video gaming, and so the word 'online' was substituted for each instance of 'video' for each of the twenty questions (see table 2 in Appendix). Each variable asked the respondent to record how often they felt a specific action described their online video game playing behaviour. Responses were recorded as '0 = Never', '1 = Rarely', '2 = Sometimes', '3 = Often', and '4 = Always'. Each variable that forms the PVGT had approximately six hundred

sixty valid cases. The PVGT displayed very high internal consistency as measured by the Cronbach's alpha (.951).

Problem gambling. One primary independent variable examined in this analysis is the Problem Gambling Severity Index (PGSI), which is a subset of the Canadian Problem Gambling Index (CPGI). The PGSI uses nine questions which assess only problematic gambling, whereas the original CPGI uses thirty-one questions which further assess risk factors and other concepts related to problematic gambling. The inclusion of the PGSI is important, as conflicting perspectives exist regarding the connection between problem gambling and problematic video gaming (King et al., 2011). Thus, the inclusion of the PGSI in this analysis allows for the exploration of the relationship between problem gambling and problem video gaming.

Importantly, not all 696 individuals who reported spending time playing video games also reported gambling activities. In order to maintain these individuals within this analysis, respondents who did not answer the PGSI questionnaire portion of the SLWBS were given a PGSI score of 0. Doing so places these individuals into the 'non-problem gambler' category of the PGSI. The PGSI asks respondents to rate, on a four-point scale how often they have experienced each of nine items over the past twelve. For example, respondents might be asked 'have you bet more than you could really afford to lose' or 'has gambling caused you health problems, including stress or anxiety' and recorded their responses as either 'never', 'sometimes', 'most of the time', and 'all of the time'. The PGSI was then recoded in SPSS 20 in order to separate gamblers into four categories of gamblers including 'non-problem gamblers', 'low risk gamblers', 'moderate risk gamblers', and 'problem gamblers' (Currie et al., 2013). The PGSI in this sample had a high level of internal consistency as measured by its Cronbach's alpha (.892). A total of 569 (82.5%) of students were listed as non-problem gamblers, 90 (13%) of students were low risk gamblers, 12 (1.7%) of students fit the moderate risk gambler category, and 19 (2.8%) students fit into the problem gambler category.

Anxiety. The SLWBS uses the seven item Generalized Anxiety Disorder (GAD-7) index to assess generalized anxiety disorder (Spitzer, Kroenke, Williams, & Lowe, 2006). Respondents were asked to score how often they felt certain problem feelings, such as 'not being able to stop or control worrying', and responses were recorded on a four point scale that included the options 'rarely or none of the time (less than one day per week)', 'some or a little of the time (1-2 days per week)', 'occasionally or a moderate amount of time (3-4 days per week)', and 'most or all of the time (5-7 days per week)'. While the original GAD index contained thirteen items adapted from the DSM-IV criteria for diagnosis and other generalized anxiety disorder measures, the GAD-7 contains only those original seven items with the highest correlation among them. Importantly, the GAD-7 does not assess other forms of anxiety, such as social anxiety, and therefore remains a tool only for the purpose of assessing generalized anxiety disorder. The GAD-7 displayed a high degree of internal consistency as measured by its Cronbach's alpha (.889).

Depression. The SLWBS includes the Center for Epidemiological Studies Depression (CES-D) scale, the original scale proposed by Radloff in 1977. The CES-D is a twenty-item index, with higher scoring users displaying more depressive symptoms. Respondents were asked to rate how frequently they felt or behaved a certain way in the past month, such as 'I was bothered by things that usually don't bother me' and 'I had crying spells'. Responses were on a four point scale with options including 'rarely or none of the time (less than one day per week)', 'some or a little of the time (1-2 days per week)', 'occasionally or a moderate amount of time (3-4 days per week)', and 'most or all of the time (5-7 days per week)'. Importantly, this measure does not reflect current DSM criteria, and thus there is disagreement about the diagnostic capacity of the CES-D. For this purpose, a revised version of the CES-D which

utilizes DSM-IV criteria, the CESD-R, has been proposed (Eaton, Smith, Ybarra, Muntaner, & Tien, 2004). However, the CES-D is still utilized due to its comparability to other studies of depression and its compatibility with other measures of depression. The CES-D used in this sample displayed very high internal consistency (Cronbach's alpha = .913).

Stress. Operationalization of stress remains a difficult task, as stress itself is not experienced similarly across all individuals (Linden, 1984). Linden created the Life Events Scale for Students (LESS) as a means of measuring students' perceived stress associated with particular life events they experienced. The LESS is a thirty-six item scale that lists particular life events, such as the death of a parent or losing a good friend among others, that may affect university students. The SLWBS uses a modified version of the LESS with thirty-four items, after combining the items 'failing a course' and 'failing a number of courses' into a single 'failing a course(s)' category, while eliminating the items 'family get-togethers', 'vacation with parents' and 'vacation alone/with friends' and replacing them with two open ended response options. Respondents were asked to indicate which of the life events that they had experienced, and to score each item selected on a scale from zero to one hundred, where higher scores represent a higher degree of perceived stress. Respondents in this survey that selected no items and provided no scores were given a score of zero (no stress) in order to maintain them within the analysis. The modified LESS displayed acceptable internal consistency in this sample (Cronbach's alpha = .750).

Impulsiveness. The Barratt Impulsiveness Scale (BIS-11) contains 30 items which are designed to specifically measure impulsiveness, a "predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individuals or to others" (Stanford et al., 2009, p. 385). Respondents were asked to rate how well a particular statement described them, for example 'I plan tasks carefully' and 'I do things without thinking'. Response options included 'rarely', 'occasionally', 'often', and 'almost always/always'. Higher scores on the BIS-11 reflect greater impulsivity symptoms. According to Patton, Stanford and Barratt (1995), individuals who scored above 74 are characterized by high-impulsiveness, while scores between 52 and 71 are within the normal limits for impulsiveness. The BIS-11 displayed a high degree of internal consistency as measured by the Cronbach's alpha (.822).

Self esteem. The Rosenberg Self-esteem (RSE) scale was included as part of the SLWBS. The RSE allows respondents to self-conceptualize their self-esteem by connecting the psychological understanding of 'the self' with the common understanding of what self-esteem is (Gray-Little, Williams, & Hancock, 1997). This is a ten-item scale, with higher scores being related to higher levels of self-esteem. Respondents were asked to what extent they agreed with statements such as 'at times, I think I am no good at all' or 'I feel that I have a number of good qualities'. Response options included strongly disagree', 'disagree', 'agree', and 'strongly agree'. The RSE displayed a high level of internal consistency (Cronbach's alpha = .904).

Social alienation. The SLWBS includes the Social Alienation Scale (SAS) originally proposed by Jessor and Jessor (1977), which has displayed "high validity and correlates fairly highly with several other scales" (Safipour, Tessma, Higginbottom and Emami, 2010, p. 517). Scores on the SAS range from 0 to 60, with higher scores relating to a higher degree of social alienation. Respondents were asked to record how strongly they agreed with each statement, such as 'I sometimes feel that the people I know are not too friendly' and 'I often wonder whether I am becoming the person I want to be'. Responses were recorded as either 'strongly disagree', 'disagree', 'neutral', 'agree', and 'strongly agree'. The SAS had a high level of internal consistency (Cronbach's alpha = .846).

Positive mental health. Another measure used in this analysis is the Mental Health Continuum Short Form (MHC-SF). Mental health has recently been viewed as something independent from mental illness, and not simply the absence of mental illness, and the MHC-SF attempts to measure emotional well-being, social well-being, and psychological well-being (Lamers et al., 2011). Keyes (2002) recommends two methods of scoring individuals on the MHC-SF: continuous and categorical scoring. Categorical scoring involves separating individuals based upon their responses to individual items within the MHC-SF index and assessing their various reported symptoms, whereas continuous scoring takes the sum of the scores and adds them up, with higher scores representing a higher degree of mental well-being. This study does not require the in depth analysis of the MHC-SF the categorical scoring provides, and thus the MHC-SF is used in its continuous form. Respondents were asked to record how often they experienced each item in the past month, such as 'happy', 'interested in life', and 'that your life has a sense of direction or meaning to it'. Response options were 'never', 'once or twice', 'about once a week', 'about 2 or 3 times a week', 'almost every day' and 'every day'. The MHC-SF displayed a very high level of internal consistency according to its Cronbach's alpha (.919).

Life satisfaction. Diener's Satisfaction With Life Scale (SWLS) was also included in the SLWBS and measures individuals' personal subjectivity in their judgment of their own life satisfaction, based upon their own judging criteria that is not "externally imposed" (Diener et al., 1985, p. 71). This scale uses five items to assess subjective well-being, with individuals who score higher on the scale having a higher level of self-reported life satisfaction. Respondents were asked the extent to which they agreed with each statement, such as 'in most ways my life is ideal' and 'if I could live my live over, I would change almost nothing'. Possible responses included 'strongly disagree', 'disagree', 'neutral', 'agree', and 'strongly agree'. The SWLS displayed high internal consistency (Cronbach's alpha = .869).

Motivations for online video gaming. The Motivations for Online Gaming Questionnaire (MOGQ) is a twenty-seven item scale which contains seven subscales which address the motivations described as *escape, coping, fantasy, skill development, recreation, competition, and social* (Demetrovics et al., 2011). Of interest to this study were the motivation of escape, coping, recreation, competition, and social, due to the similarity these motivations share with problematic gambling. Respondents were asked to rate how often they played video games for each reason listed, such as 'because I can get to know new people', 'because I like to win', and 'because it improves my skills'. Response options included 'almost never', 'some of the time', 'half of the time', 'most of the time', and 'almost always/always'.

Escape and coping. Escape is described as a motivation in which gamers seek an escape from every day reality, and is measured using four items within the MOGQ. Similarly, *coping* is described as a motivation in which individuals play games as a means of alleviating stress and improving mood, and is likewise measured by four items within the MOGQ. Coping and escape had previously been viewed as a single dimension of the MOGQ as they are often highly correlated with one-another. However, these motivations differ enough in their definitions to warrant separate analysis. Escape (Cronbach's alpha = .919) and Coping (Cronbach's alpha = .883) displayed high internal consistency.

Competition. Competitiveness refers to gamers' desire to "compete with and defeat" other individuals while providing a sense of achievement (Demetrovics et al., 2011, p. 820). Competitiveness is measured using four items in the MOGQ, with higher scores reflecting a stronger competitive motivation for gaming. This motivation is important, as hyper-competitiveness in gaming is frequently described as a strong predictor of problematic video

gaming. Competitiveness displayed a high level of internal consistency (Cronbach's alpha = .882).

Social. The social motivation dimension measures individuals' desire to participate in online games as a means of meeting and interacting with other people. The MOGQ measures the social motivation using four items, with a higher score representing a greater desire to play online games for sociality. The social motivation displayed high internal consistency (Cronbach's alpha = .852).

Recreation. The recreation variable measures individuals' desire to play games as a form a pleasure, or to simply relax and have fun. Recreation is measured by three items within the MOGQ. The recreation motivation had a high level of internal consistency as measured by the Cronbach's alpha (.865).

Skill development. Skill development refers to being motivated to play games "in order to improve … coordination, concentration, or other skills" (Demetrovics et al., 2011, p. 820). Four questions ask the respondent to rate how frequently they play games to enhance concentration abilities or for skill development. Together, these questions measure how respondents use video games as a tool to enhance abilities, both inside and out of the video game. Skill development had a very high level of internal consistency (.941).

Fantasy. Finally, the fantasy motivation attempts to measure how frequently individuals play games in order to "step out of one's usual identity" and performing actions or activities "that one cannot do in real life" (Demetrovics et al., 2011, p. 820). Four items ask the respondent to rate how often they play video games in order to be someone or somewhere else in a video game world. The final four-item index measures a desire to play video games to enter into an imaginary world and be an imaginary person. Fantasy displayed very high internal consistency according to its Cronbach's alpha (.907).

Time. The SLWBS asked respondents how long they spent playing video games in a typical week in the last month, and were asked to record their response in minutes played. This data was then used to separate the amount of time gamers played into four separate categories: Seven hours or less, More than seven hours and up to fourteen hours, More than fourteen hours and up to twenty hours, and more than twenty hours. Separating the time into these categories maintains generally equal intervals of time for each category, while allowing for adequate distribution of respondents among all categories. This manner of categorizing gaming time is similar in its application to the study performed by Desai and colleagues (2010) which looked at correlates of video gaming.

Sex. SLWBS respondents were asked to report their sex. Males were coded as 0 and females were recorded as 1. This resulted in the construction of a dichotomous 'sex' variable.

Results

First, exploratory factor analysis was performed using principal components analysis in SPSS version 20 on the twenty PVGT items. The results of the PCA extraction are present in Table 3 of the Appendix. While three factors were extracted, all items had their strongest loadings on a single factor. This single factor has an associated eigenvalue of 10.573, and explains over fifty-percent of the variance among PVGT items. Thus, the PVGT is best explained by a single factor solution.

Second, bivariate associations between PVGT and predictors were assessed through Pearson correlation coefficients and are presented in Table 4 of the Appendix. Among items used in the original PVGT validation study (King et al., 2011), our measure for anxiety (r=.164, p<.01), depression (r=.247, p<.01) and time (.448, p<.01) displayed a similar relationship to the PVGT in this sample. The measure for stress, however, was not significantly related to PVGT scores. Thus, with the exception of the stress variable, it appears that the PVGT is an acceptable measure for problem online video gaming in this sample.

Next, additional items, not included in King et al. (2011) but theorized to have a relationship with PVGT scores, were analyzed at the bivariate level (also see Table 4). Among these items, impulsiveness (.168, p<.001) and social alienation (.297, p<.001) were positively associated with higher PVGT scores, whereas mental well-being (-0.226, p<.001), life-satisfaction (-0.225, p<.001) and self-esteem (-0.208, p<.001) were negatively associated with higher PVGT scores. Additionally, sex was negatively associated with PVGT scores (-0.310, p<.001) reflecting that females score lower on the PVGT than males. The gaming motivations for *competition* (.591, p<.001)*, escape* (.712, p<.001)*, social* (.658, p<.001)*, cope* (.715, p<.001)*, recreation* (.525, p<.001)*, skill development* (.585, p<.001) *and fantasy* (.636, p<.001) had the strongest positive associations with PVGT scores. Importantly, the association between PGSI scores and PVGT scores was insignificant.

Finally, multivariate analysis was conducted in the form of an Ordinary Least Squares regression model. The standardized beta values are presented in Table 5 of the Appendix. Model 1 included only the items used in the PVGT validation study, whereas Model 2 included the additional items theoretically related to problem online video gaming and problem gambling. Model 1 suggested that depression (beta=.251, p<.001) and time (beta=.421, p<.001) has moderate effects on PVGT and were significant predictors of PVGT scores, however this was no longer the case when all items were accounted for in Model 2. In this model, social alienation (beta=.170, p<.001), time (beta=.142, p<.001), and the gaming motivations for competition (beta=.115, p<.01), cope (beta=.108, p<.05) and recreation (beta=.142, p<.01) displayed small effects on PVGT scores, whereas the gaming motivations escape (beta=.288, p<.01) and social (beta=.234, p<.01) displayed moderate effects on PVGT scores.

Discussion

The results from exploratory factor analysis lend support to the finding by King and colleagues (2011), that the PVGT is measuring a single factor that can be labelled problematic online video game play. The PVGT displayed a high level of internal consistency (Cronbach's alpha = 0.951) and an analysis of correlations between individual PVGT items and the overall PVGT displayed strong correlations (r>0.6). Item loadings from the principal components analysis factor extraction revealed similar results to those found by King and colleagues (2011) in their preliminary validation study on the PVGT, where factor loadings had an average strength of 0.74. Furthermore, an analysis of known correlates to problem online video gaming yielded expected results. Time spent gaming had a moderate, positive correlation with the PVGT (r=0.45, p<.01), suggesting that the PVGT does reflect a heavier amount of gameplay. Additionally, the mean PVGT score in this study was 13.12 with a standard deviation of 14.09, and the distribution of scores was approximately normal (skewness = 1.330, kurtosis = 1.702). This finding echoes the results from King and colleagues (2011, p. 79), where this result for the PVGT is "consistent with the literature" on problem gaming, since "only a minority of players experience significant disruption as a result of excessive video game playing".

A check for convergent validity performed by King and colleagues (2011) involved the use of the Depression Anxiety Stress Scales (DASS) to explore the relationship between measures for depression, anxiety, and stress and the PVGT. This study attempted to replicate this convergent validity test by using measures for depression, anxiety, and stress that had been included in the SLWBS. In the case of depression, the CES-D was weakly positively correlated with the PVGT ($r=0.25$, $p<.01$). Similarly, King and colleagues (2011) found that the DASS depression measure was weakly positively associated with the PVGT ($r=0.18$, $p<.01$). For anxiety, the GAD-7 was also weakly positively correlated with the PVGT ($r=0.16$, $p<.01$). While King and colleagues (2011) found a slightly stronger relationship between anxiety (DASS anxiety) and the PVGT ($r=0.29$, $p<.01$), both studies indicate a weak relationship between anxiety and problem video gaming. Stress, as measured by the LESS in the SLWBS, did not display a significant correlation with PVGT scores. This may be explained by the differences in measurement between the DASS-stress index and the LESS.

Correlations between items used in these models revealed no correlations above 0.9, with the highest correlation found between GAD-7 and CES-D ($r=0.72$). Therefore, this model does not appear to contain redundant measures. Additionally, multicollinearity diagnostics – no variance inflation factor values exceeded 5 and no tolerance values were below 0.2 – indicated that multicollinearity was not a concern (O'brien, 2007).

At the multivariate level, there was not evidence of a significant relationship between risk factors for problem gambling and problem online video gaming. When other items were controlled for in a multivariate OLS regression, anxiety, depression, stress, impulsiveness, mental health, life satisfaction, and self-esteem did not have a significant association with PVGT scores. Additionally, sex did not have a significant relationship to PVGT scores as well.

While mental health measures were not significant predictors of PVGT in the regression model, the motivational factors of escape ($r=0.71$, $p<.01$) and coping ($r=0.72$, $p<.05$) had the strongest bivariate positive associations with PVGT and remained significant predictors of PVGT scores at the multivariate level. This finding may be unsurprising, as a desire to escape or cope with life problems is perceived as a primary motivation for drinking amongst problem drinker populations, and this relationship had been hypothesized to be similar for problem video gamers (Demetrovics et al., 2011). Similarly, problem gambling is often exacerbated by individuals who gamble as a means of displacing the negative effects of mental illness (Blaszczynski & Nower, 2002). Thus, individuals who are problem video gamers appear to use video gaming as a way of displacing negative feelings and emotions, which suggests the comorbidity of low mental well-being or mental health and problem video gaming. Although mental health measures were not significant at the multivariate level, there is bivariate evidence that suggests some level of relationships. Again, it may be that certain groups of gamers might be exhibiting problematic video game play as a means of displacing the negative symptoms associated with low mental well-being.

Importantly, social alienation, as measured by the SAS, is a significant predictor of the PVGT at both the bivariate and multivariate levels. Although social alienation was only weakly associated with the PVGT at the bivariate level it remained a significant predictor of PVGT when other factors were considered. Thus, individuals in this sample who reported feeling socially alienated were more likely to score high on the PVGT. This finding supports the hypothesis that excessive video gaming comes at the cost of social connections outside of the video game world (Colwell & Kato, 2003). Furthermore, the social motivation significantly predicted PVGT scores as well, reinforcing the understanding that those who feel socially alienated in the physical world are seeking social connections in the digital world. The significant relationship between social alienation, social online gaming motivation, and problem online video gaming

suggests that a lack of connectedness to the social world and a desire for sociality is characteristic of problematic video game playing.

The recreation dimension, measuring the motivational force of fun in video games, was moderately associated with the PVGT at the bivariate level. Importantly, this dimension appeared to be the strongest motivational factor predicting video game play, as it measures a "basic need to recreation and fun" (Demetrovics et al., 2011, p. 823). At the bivariate level, the recreation motivation had the weakest relationship to the PVGT among other MOGQ items. This is perhaps due to the fact that while video games are most often played for fun or as a form of entertainment, problematic video game play extends beyond simple fun and other motivational forces take precedent. At the multivariate level, recreation has a similar effect size to the motivations coping and competition, but smaller than the *social* and *escape* factors.

The desire to escape the negatives of real-life is the strongest predictor of problematic video game play as measured by the PVGT. This is consistent with previous findings that escaping negative feelings and moods are associated with problem gambling and other substance abuse disorders, and to problem video game playing (Sim et al., 2012; Demetrovics et al., 2011; Blaszczynski & Nower, 2002). Importantly, gambling researchers have pointed to the role escape plays in alleviating feelings associated with mood disorders, and while these were not as prevalent a predictor of problematic video game play in this study, there are potentially classes of gamers who play video games for similar reasons.

This study did not confirm a relationship between problem gambling risk and problem video gaming. The PGSI was an insignificant predictor of the PVGT at either the bivariate or multivariate level. However, this result may, in part, be due to the skewed distribution of PGSI scores (skewness=2.965), as the vast majority (81.8%) of video gamers fell into the 'non-problem gambler category' while only 2.7% fell into the 'problem gambler' category. Thus, further exploration of the relationship between problem gambling and problem video gaming in a sample with a larger number of problem gamblers is necessary to establish or refute a link between these disorders.

Importantly, evidence of a connection between certain risk factors for problem gambling and problem gaming was present at the bivariate level, but disappeared when they were controlled for in a multivariate model. King and colleagues (2011) discussed the potential for the existence of distinct subgroups of gamers with particular characteristics and motivations may exist, and that problematic gaming behaviour may be experienced differently based upon these unique subgroup characteristics. Thus, depression may be a risk factor for problem video gaming for certain individuals (sub-types of gamer), but this effect is diminished when looking at video gamers as a single entity.

While Study 1 extends the use of the PVGT as a measure of problem video gaming among university students, further research could explore the PVGT among other populations of gamers that are at a higher potential risk for problematic play. The findings of Study 1 suggest the potential existence of subtypes of gamers. The unobserved (insignificant) relationships between items expected to influence problematic video game playing may suggest that such factors do not describe the problematic video game playing population as a whole, and that only certain subgroups of gamers may exhibit high prevalence rates of depression, anxiety or other mental illness, or low mental health. Mixture modeling techniques such as latent class analysis could be used to identify subpopulations (classes) of gamblers based on preferred genre of play and related characteristics, and whether some classes of online gamer are more or less at risk for disordered gambling and associated comorbidities.

STUDY 2

Introduction

The second study builds on the first by further examining the connections between online gaming and gambling through a latent class analysis (LCA) of online gamers to (a) determine if there are distinct classes of online gamers based on gaming activities, and (b) whether the hypothesized risk and protective factors examined in Study 1, including problem gambling, help distinguish between different classes of online gamer. LCA is a technique that allows for the classification of study participants into distinct subgroups or classes by modelling their response distributions across "multivariate categorical data" (Dean & Raftery, 2010, p. 11; Muthén & Muthén, 2000). Then, various selection techniques are applied which result in the determination of the optimal number of classes present in the model.

Method

SLWBS respondents that reported playing online video games were then asked to report the average amount of time they spent playing various platforms and/or modes of online video games in a typical week in the past three months. The video game platform categories included social networking sites, social networking sites (gambling themed games), console (home/handheld), PC (computer), F2P ('free-to-play' games), Smartphone/tablet (mobile), MMORPG (massively multiplayer online role-playing games), gambling sites (play money) and gambling sites (real money). Each category was recoded into binary variables, where 0 = does not play and 1 = spent time playing, and thus a score of 1 in any category meant that respondent played online video games on that particular video game platform (see Table 7 in Appendix for items).

Latent Class Analysis was conducted using Mplus version 7.4 to enumerate subgroups of gamers based upon their self-reported use of each online video gaming platform. Response probabilities were obtained indicating the individual probabilities of reporting playing each particular online video gaming platform, and thus allows for the assessment of each group's relationship to theoretically related risk factors for problem online video gaming and problem gambling. To determine the best class fit for the data, several models were derived which utilized a step-wise inclusion of classes in each subsequent model, with each model being assessed for its stability.

Model stability was assessed through the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and adjusted Bayesian Information Criterion (aBIC). Overall model probability was assessed through the entropy measure, where higher values indicate better model classification (McCutcheon, 2002).

In the second part of this study, multinomial logistic regression is used to compare groups on a number of theorized correlates of problem online gaming and gambling (see Study 1 for a literature review and description of variables and measures), to assess whether these variables help distinguish between different activity-based latent classes of online gamer.

Results

Model fit statistics are reported in Table 6 of the Appendix. The AIC and aBIC were lowest in a five-class model (5479.588 and 5546.090 respectively), while the BIC was lowest on a three-class model (5665.939). Furthermore, our measure for entropy was highest in a four-class

solution (.923), which suggests that a four-class model has the highest classification probability. However, the AIC and aBIC for the three-class model was only slightly higher than that of the five-class model (5534.502 and 5573.860 respectively) while the entropy value was only slightly smaller than the four-class solution (.913 for three-class model). To assist in determining the optimal class model, Vuong-Lo-Mendell-Rubin Likelihood Ratio test scores were obtained, which tests whether there is a "statistically significant improvement in fit for the inclusion of one more class" (Nylund, Asparouhov, & Muthén, 2007, p. 538). This test was significant for the three-class model, but was not significant for the four-class model, suggesting that additional classes beyond the third did not significantly improve model fit. Taking all of these factors into account, a three-class model solution was selected.

Conditional probabilities were then obtained to determine class membership. Conditional probabilities are reported in Table 7 of the Appendix and the associated pattern-graph is displayed in Figure 1. Furthermore, Table 8 in the Appendix provides descriptive characteristics for each of the three classes as they relate to items theoretically associated with problem online video gaming and problem gambling.

Class 1 is characterized by a high degree of playing online video games across each video game platform, but also by the fact that they played gambling themed games. This class of cross platform game users displayed the highest average scores for problem online video gaming (mean = 31.92, SD = 20.226), anxiety (mean = 9.95, SD = 11.144), depression (mean = 20.78, SD = 11.144), stress (mean = 258.79, SD = 292.486), impulsiveness (mean = 72.63, SD = 7.805), social alienation (mean = 26.94, SD = 6.718) and problem gambling (mean = 2.35, SD = 1.348). Among motivations, this class had the highest average score for escape (mean = 5.33, SD = 4.270), cope (mean = 6.11, SD = 4.283), skill development (mean = 6, SD = 4.589), social (mean = 5.72, SD = 4.824) and fantasy (mean = 6.06, SD = 4.734). Importantly, very few respondents fit this 'multimodal gamers' class (2.9% of the sample).

Class 2 is characterized by a large proportion of 'free-to-play' gamers. This subgroup also had a higher likelihood of playing video games on a personal computer and had a higher likelihood of playing MMORPG games, but is different from Class 1 in that they are unlikely to play gambling themed games, regardless of whether the games involve play or real money. This class of gamers had the highest average time spent playing games (mean = 2.03, SD = 1.128) and had the highest average self-esteem scores (mean = 19.73, SD = 5.678). In terms of gaming motivations, this group had the highest average score for competition (mean = 6.78, SD = 4.558) and recreation (mean = 9.21, SD = 2.842). This class, which we have labelled 'F2P gamers', represented 22.4% of the sample.

Class 3 is very similar to Class 2 players in terms of response probabilities. Like Class 2, Class 3 did not play gambling games of any type. They were equally as likely as class 2 to play online video games on consoles or smartphones. However, class 3 has a much lower probability of playing free-to-play online video games. This class displayed the highest average score for positive mental health (mean = 46.97, SD = 12.372) and life satisfaction (mean = 12.07, SD = 4.138). Class 3, which we have labelled 'non-F2P gamers', made up the majority of the sample (74.7%).

In order to compare these three groups of online video gamers on the various risk and/or protective factors for problem online video gaming and problem gambling, multinomial logistic regression was performed in SPSS version 20. The odds ratios from these regressions are reported in Table 9 of the Appendix.

Membership in the class of 'multimodal gamers' was, when compared with Classes 2 and 3, predicted by higher scores related to problem online video gaming, impulsiveness, and

problem gambling. Additionally, this class is characterized by a lower motivational impact related to recreation. In relation to class two, a one point increase on the PVGT leads to an increase in ten percent of the odds that an individual would be placed in this cross platform 'multimodal gamers' group (OR = 1.111, p<.05). Similarly, in relation to Class 3, an increase of one unit in PVGT score leads to a 15% increase in the odds of being placed in Class 1 compared to Class 3 (OR = 1.145, p<.05). In terms of impulsiveness, a single point increase on the BIS-11 scale leads to a corresponding increase of 10% in the odds of being placed in Class 1 over Class 2 (OR= 1.092, p<.05) and Class 3 (OR = 1.106, p<.05). In terms of problem gambling, an increase of one unit (from the non-risk to low-risk category, for example) is associated with nearly 5 times greater odds of being in Class 1 over Class 2 (OR = 4.847, p<.001) and 4 times greater odds of being in Class 1 than Class 3 (OR = 4.112, p<.001). Among motivations, the recreation motivation negatively predicts membership into this multimodal gamers class. When compared with Class 2, a single unit increase in the motivation recreation lowers the odds of being in Class 1 by 50% (OR = .492, p<.001). A similar situation is present when compared with Class 3, where a single unit increase in the recreation motivation corresponds with a 43% decrease in the odds of being placed in Class 1 (OR = .573, p<.01).

Membership into Class 2 (F2P gamers), when compared with Class 3 (non-F2P gamers), is predicted by problem online video gaming scores, average weekly time spent playing games, sex, and the motivational factor of recreation. A single unit increase on PVGT scores corresponds to a three percent increase in the odds of being placed in Class 2 over Class 3 (OR = 1.031, p<.05). A one ordinal unit increase in the time variable (from 'less than seven hours per week' to 'more than seven hours and up to fourteen hours per week', for example) corresponds to a slightly higher than 40% increase in the odds of being placed in Class 2 over Class 3 (OR = 1.428, p<.01). As sex is a dichotomous variable, being male corresponds with a 66% chance of being placed in Class 2 over Class 3 (OR = .335, p<.001). A single unit increase on the recreation motivation corresponds with almost a 17% increase in the odds of being placed in Class 2 over Class 3 (OR = 1.165, p<.001). Finally, a single unit increase on the fantasy motivational scale corresponds with a decrease in the odds of being placed in Class 2 over Class 3 by almost 9% (OR = .914, p<.05).

Discussion

The results from the latent class analysis revealed three dominant subgroups of gamers, those who are 'multimodal gamers', those who are 'F2P gamers' and 'casual non-F2P gamers' (whom are much more likely to be female). The class of gamers who played gambling themed games were characterized by higher scores for problem video gaming, and membership into this class was heavily predicted by problem gambling (higher scores on the PGSI). Importantly, membership in this gambling class of gamers is not predicted by a motivation for recreation.

When it comes to assessing the characteristics of the 'F2P gamers' and 'non-F2P gamers', we see that the F2P class of gamers spend significantly more time playing video games, are more likely to be male, have a slightly higher degree of problematic online video game playing scores, and are highly motivated by recreation. This finding appears to contradict the suggestion that females are largely attracted to free to play 'casual' games (King et al., 2013). However, it is important to note that the general category of free-to-play games encapsulates a large array of video games, ranging from the popular *League of Legends* computer game to the popular mobile game *Clash of Clans* (Chew, 2016). Not only does the free-to-play umbrella include games that span video game platforms, but they vary in terms of structural elements, which may include vastly different "monetization methods" in addition to offering a variety of gameplay experiences (Chew, 2016, p. 229). Importantly, however, there is

a dearth of scholarly inquiry into characteristics of F2P games, and therefore these sub-classes of gamers are in significant need of study (Chew, 2016).

Limitations

One limitation of this study relates to the diverse nature of video game players. First, if we were to apply Young's (1998) categorical cut-off points to the PVGT continuous scores, 63.4% of scores on the PVGT from the SLWBS fall into the category labelled "average users" in relation to internet use, while only 1.6% of PVGT scores would fall into the "significant problems associated with the internet" category (King et al., 2011, p. 77). Consistent with King and colleagues' (2011) scoring for problem video gaming, this study used and recommends the continued application of the PVGT as a continuous measure until further exploration of the PVGT takes place, and its connection with clinical diagnostic scores can be established. Thus, the current understanding of the PVGT remains that higher scores reflect a higher degree of problems associated with video game playing.

One significant step that could assist in interpreting PVGT scores involves an analysis of the underlying characteristics of gamers. The Latent Class Analysis performed in this study was unable to isolate individuals who specifically played MMORPG games, who are perceived as one of the groups of gamers whom are at higher risk of developing problematic video game play (King et al., 2013). Additionally, the subgroup of gamers who played gambling themed games was quite small, and therefore purposeful sampling of members to this subgroup of gamer could yield valuable information regarding the connection between risk factors for problem gambling and problem online video gaming.

Similarly, this project was unable to establish a link between the PGSI and the PVGT, suggesting that problem video gaming and problem gambling are not comorbid effects. This result should be viewed with extreme caution, however, and future research should seek to recruit individuals who actively participate in both activities, and, compare gamers and gamblers who exhibit similar scores across both activities, or recruit gamers from online social casino games, etc. This examination could provide valuable information regarding the potentially comorbid relationship between problem video gaming and gambling.

Importantly, the generalizability of this study was limited by it reliance on a convenience sample of university students. Future studies should explore youth gamblers and gamers outside of a university population to more broadly assess potential connections between risk factors for problem gambling and problem gaming.

Finally, the data used in this project is cross-sectional and relied on self-report responses. Further studies could utilize longitudinal methodology that can track players' behaviour and interactions with video games. This could eliminate any potential bias that might arise from self-report statistics, while providing rich data and insight into the connection between risk factors for problem gambling and their connection to problem video gaming.

Conclusion

In Study 1, analysis of PVGT items provided evidence that the PVGT is good measure for the general concept of problem video game playing. The results from EFA support the PVGT creators' claim that it is a unidimensional measure of problem gaming (King et al., 2011). Furthermore, PVGT construct validity was assessed through convergent validity checks with

known correlates with problematic gaming behaviour. The PVGT demonstrated expected associations with length of time spent gaming in a typical week, and the selected measures for anxiety and depression similar to the original findings of King and colleagues (2011). Thus, the evidence suggests the PVGT is a valid measure for problem video gaming in this sample of university undergraduate students.

Importantly, there was no evidence of connections between problem gaming and concepts traditionally explored in problem gambling literature, such as mental health, life satisfaction, impulsiveness, and self esteem. While each of these variables was significantly associated with PVGT scores at the bivariate level, none were significant at the multivariate level. This could suggest that the phenomenon of problem video gaming differs from problem gambling in its relationship to these variables.

Motivations for online gaming were among the strongest predictors of PVGT (with the exception of the fantasy and skill development motivational factors), suggesting highly motivated gamers were more likely to play at problematic levels than those less motivated. Motivations are seen as playing a significant role in the development of problematic play, and should be explored in problem video gaming and problem gambling studies due to the similarities they share (Demetrovics et al., 2011; Hollingshead et al., 2016). Importantly, feeling socially alienated in the off-line world positively influenced PVGT scores, and higher PVGT scores were associated with a desire for social online video game play. The desire for social connectedness appears to overlap with gambling, where some individuals are motivated to gamble “because it satisfies the player’s social needs” (Hollingshead et al., 2016, p. 56). Thus, research should explore the nature of digitally formed relationships, and how a lack of social connectedness in the off-line world can form a pathway to problematic video game playing.

In Study 2, Latent Class Analysis revealed a specific group of gambling gamers that displayed a significant relationship to problem gambling, this interpretation should be viewed with caution due to the low number of survey respondents classified in this subgroup. Importantly, previous research has suggested that youth who are exposed to online gaming at an earlier age are at a higher risk of developing future gambling problems (Derevensky and Gainsbury, 2016), and it would be interesting if future research could track heavy-use online gamers to better understand its potential impact on the development of future problem gambling. Thus, future research should aim to obtain a larger sample by, for example, purposeful sampling of online video gamers who participate in these activities. Such increased statistical power would enhance to the ability to determine the exact nature of the risk factors that connect such players video gaming habits with problem gambling.

There is a growing body of research that suggests that gambling themed games found on social networking sites present a significant risk factor for developing future problem gambling, due to the age at which individuals can participate in such games, the ease at which one can find and play them, and the structural similarities shared between them and real-money gambling games (King et al., 2011; Hollingshead et al., 2016; Griffiths et al., 2016). While membership in the class of multimodal gamers in this study appeared to be predicted by scores on the PVGT and PGSI, future research should explicitly examine social networking and social casino gamers to determine the true nature of this connection.

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APPENDIX

Table 1: *Descriptive Statistics for Continuous Variables*

Variable	*Mean*	*Standard Deviation*	*Range*
Dependent Variable			
PVGT	13.12	14.093	0-77
Predictor Variables			
Problem Gambling			
PGSI	1.25	.622	1-4
Mental Health Measures			
GAD-7	8.69	5.349	0-21
CES-D	17.75	10.757	0-56
LESS	229.64	226.34	0-2190
BIS-11	62.78	10.194	38-102
RSE	19.52	5.753	1-30
SAS	25.37	9.143	1-55
MHC-SF	46.51	12.327	10-70
SWLS	11.88	4.176	0-20
Motivations for Online Gaming			
Competition	4.28	4.38	0-16
Escape	2.97	4.12	0-16
Social	2.35	3.477	0-16
Coping	3.83	4.183	0-16
Recreation	6.95	3.759	0-12
Skill Development	3.47	4.466	0-16
Fantasy	2.65	4.096	0-16
Other			
Time Spent Gaming	1.507	.917	1-4

Table 2: *Problem Video Game Playing Test Items*

Item	Median	Mean	Standard Deviation	Valid Cases	Missing Cases
Play online games over going out with others	0	0.80	1.10	659	37
Outburst/annoyed when someone interrupts online game session	0	0.67	0.92	660	36
Fear life without online games would be boring/empty/joyless	0	0.50	0.90	660	36
Feel preoccupied with online games when not playing	0	0.51	0.86	656	40
Block unwanted thoughts about your life with thoughts about online games	0	0.65	1.04	656	40
Neglect household chores to spend more time playing online games	0	0.86	1.04	658	38
Lose sleep due to late night online gaming	0	0.89	1.11	657	39
Feel depressed/moody/nervous when not playing games which goes away when you go back to playing online games	0	0.35	0.78	655	41
Often play online games for longer than intended	1	1.37	1.24	657	39
Try to hide how long you play online games	0	0.55	0.96	657	39
Work suffers due to amount of time spent playing online games	0	0.67	1.00	656	40
Job performance suffers due to online games	0	0.36	0.78	656	40
Become defensive/secretive when asked about how much you play online games	0	0.37	0.80	657	39
Anticipate when you can play online games again	0	0.70	1.00	652	44
Play online games before something else that needs to be done	0	0.84	1.04	657	39
Try to cut down on time spent playing online games but fail	0	0.61	0.98	656	40
Do others in your life complain about your online game playing	0	0.44	0.87	656	40
Find yourself setting and ignoring reminders to stop	0	0.87	1.13	656	40
Avoid spending time with partner/non-game playing friends to play online games	0	0.33	0.75	658	38
Play online games as a means of changing your mood (relax tension or for excitement)	0	1.05	1.27	658	38

Note. Item response range is 0-4

Table 3: PCA Extraction

Variable	Component 1	Component 2	Component 3
Play online games over going out with others	**0.719**		
Outburst/annoyed when someone interrupts online game session	**0.626**		
Fear life without online games would be boring/empty/joyless	**0.741**	0.415	
Feel preoccupied with online games when not playing	**0.726**	0.327	
Block unwanted thoughts about your life with thoughts about online games	**0.750**	0.365	
Neglect household chores to spend more time playing online games	**0.756**		
Lose sleep due to late night online gaming	**0.746**		-0.320
Feel depressed/moody/nervous when not playing games which goes away when you go back to playing online games	**0.749**	0.304	
Often play online games for longer than intended	**0.735**		-0.390
Try to hide how long you play online games	**0.683**		0.333
Work suffers due to amount of time spent playing online games	**0.740**	-0.349	
Job performance suffers due to online games	**0.707**	-0.323	
Become defensive/secretive when asked about how much you play online games	**0.708**		0.487
Anticipate when you can play online games again	**0.790**		
Play online games before something else that needs to be done	**0.767**		
Try to cut down on time spent playing online games but fail	**0.763**	-0.301	
Do others in your life complain about your online game playing	**0.703**		
Find yourself setting and ignoring reminders to stop	**0.719**		
Avoid spending time with partner/non-game playing friends to play online games	**0.693**		
Play online games as a means of changing your mood (relax tension or for excitement)	**0.702**		

Table 4: *Bivariate Correlations Between Predictors and PVGT*

Independent Variable	*Pearson's r*
GAD-7	0.164**
CES-D	0.247**
LESS	0.77
Time	0.448**
BIS-11	0.168**
MHC-SF	-0.226**
SWLS	-0.225**
RSS	-0.208**
SAS	0.297**
PGSI	0.067
Game Motivation	
Competition	0.591**
Escape	0.712**
Social	0.658**
Cope	0.715**
Recreation	0.525**
Skill Development	0.585**
Fantasy	0.636**
Sex	-0.310**

** Significance at $p < .01$,
*Significance at $p < .05$

Table 5: *Multivariate Predictors of PVGT*

Independent Variable	*Model 1*	*Model 2*
GAD-7	-0.035	0.011
CES-D	0.251***	-0.037
LESS	0.028	-.004
Time	0.421***	0.142***
BIS-11		0.023
MHC-SF		-0.028
SWLS		0.027
RSS		0.003
SAS		0.170***
PGSI		0.025
Competition		0.115**
Escape		0.288***
Social		0.234***
Cope		0.108*
Recreation		0.142***
Skill Development		-0.062
Fantasy		0.020
Sex		-0.034

*** Significance at $p < 0.001$, ** Significance at $p < .01$, *Significance at $p < .05$

Table 6: *Model Fit Statistics*

Model	AIC	BIC	aBIC	Entropy	Participants in each class n (%)
1 class	6047.472	6088.263	6059.687	-	
2 class	5690.968	5777.083	5716.755	.808	136 (19.7%)
					551 (80.2%)
3 class	**5534.502**	**5665.939**	**5573.860**	**.913**	**20 (3%)**
					154 (22%)
					513 (75%)
4 class	5505.013	5678.774	5554.943	.923	20 (3%)
					12 (1.7%)
					162 (23.6%)
					493 (71.8%)
5 class	5479.588	5701.672	5546.090	.854	120 (17.5%)
					20 (3%)
					377 (54.9%)
					158 (23%)
					12 (1.7%)

Table 7: *Conditional Probabilities*

VARIABLE	VARIABLE LABEL	LATENT CLASS 1 (n=20)	LATENT CLASS 2 (n=154)	LATENT CLASS 3 (n=513)
Q50A	Q50A. In a typical week in the past 3 months, time spent playing: online games through (or associated with) social networking sites such as Facebook	**.902**	.485	.539
Q50B	Q50B. In a typical week in the past 3 months, time spent playing: gambling-themes games through (or associated with) social networking sites such as Facebook	**.952**	.071	.086
Q50C	Q50C. In a typical week in the past 3 months, time spent playing: video games on a game console or handheld game console	.**953**	.660	.601
Q50D	Q50D. In a typical week in the past 3 months, time spent playing: PC games purchased at a store or through an online distributor	**1**	.712	.238
Q50E	Q50E. In a typical week in the past 3 months, time spent playing: "Free-to-play" (F2P) games online	.9	**.978**	.048
Q50F	Q50F. In a typical week in the past 3 months, time spent playing: Casual video games on a smartphone or tablet	**1**	.644	.682
Q50G	Q50G. In a typical week in the past 3 months, time spent playing: Massively multiplay online role-playing games (MMORPG	**1**	.542	.046
Q50H	Q50H. In a typical week in the past 3 months, time spent playing: 'Play money' gambling games associated with a gambling site	**1**	.016	.023
Q50I	Q50I. In a typical week in the past 3 months, time spent playing: 'Real money?' gambling games associated with a gambling site	**.803**	.019	.022

Figure 1: *Conditional Probabilities Graph*

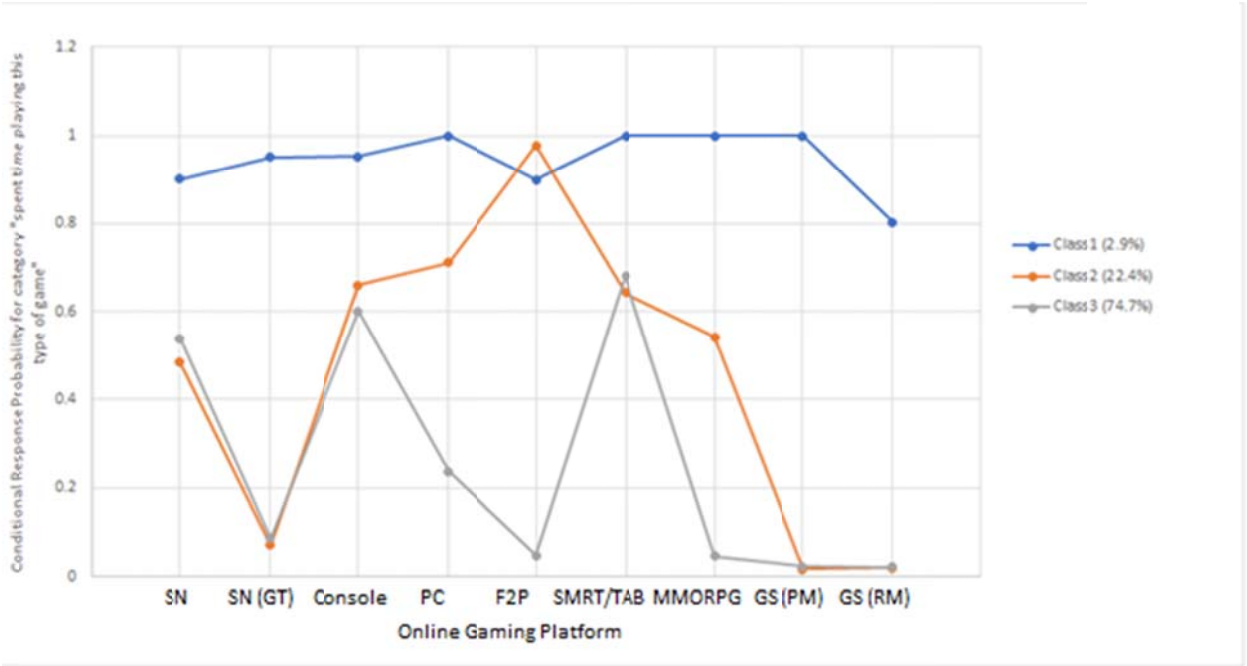

Table 8: *Descriptive Statistics by Latent Class*

VARIABLE	LATENT CLASS 1 n=20 (2.9%)	LATENT CLASS 2 n=154 (22.4%)	LATENT CLASS 3 n=513 (74.7%)	Total Sample n=687
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
PVGT	**31.92 (20.226)**	21.41 (14.764)	9.92 (12.045)	12.96 (14.019)
Anxiety	**9.95 (5.596)**	8.02 (4.804)	8.75 (5.447)	8.62 (5.32)
Depression	**20.78 (11.144)**	17.44 (10.034)	17.56 (10.873)	17.62 (10.697)
Stress	**258.79 (292.486)**	228.7 (200.183)	253.52 (223.424)	248.16 (220.115)
Impulsiveness	**72.63 (7.805)**	63.1 (10.213)	62.23 (10.076)	62.74 (10.191)
Mental Health	43.3 (14.268)	45.88 (11.704)	**46.97 (12.372)**	46.61 (12.288)
Life Satisfaction	10.79 (3.259)	11.55 (4.315)	**12.07 (4.138)**	11.92 (4.159)
Self-esteem	17.45 (5.633)	**19.73 (5.678)**	19.61 (5.749)	19.57 (5.734)
Social Alienation	**26.94 (6.718)**	25.53 (9.180)	25.16 (9.189)	25.28 (9.127)
Time playing games	1.8 (1.151)	**2.03 (1.128)**	1.33 (.758)	1.504 (.915)
Sex	.45 (.51)	.25 (.434)	**.62 (.485)**	.54 (.499)
PGSI	**2.35 (1.348)**	1.21 (.509)	1.22 (.574)	1.25 (.626)
Gaming Motivations				
Competition	6.28 (4.056)	**6.78 (4.558)**	3.41 (4.017)	4.27 (4.392)
Escape	**5.33 (4.270)**	4.48 (4.355)	2.35 (3.810)	2.92 (4.067)
Social	**5.72 (4.824)**	4.22 (3.985)	1.62 (2.916)	2.33 (3.474)
Cope	**6.11 (4.283)**	5.91 (4.322)	3.02 (3.825)	3.78 (4.152)
Recreation	5.71 (3.965)	**9.21 (2.842)**	6.26 (3.698)	6.93 (3.739)
Skill Development	**6 (4.589)**	5.76 (5.017)	2.63 (3.946)	3.45 (4.447)
Fantasy	**6.06 (4.734)**	3.84 (4.260)	2.11 (3.822)	2.62 (4.056)

Table 9: Odds Ratios for Group Comparisons

VARIABLE	1 vs. 3	1 vs. 2	2 vs. 3
Problem Video Gaming	**1.145 (.044)****	**1.111 (.045)***	**1.031 (.013)***
Anxiety	1.025 (.094)	1.067 (.097)	.960 (.031)
Depression	.940 (.060)	.942 (.062)	.998 (.021)
Stress	.999 (.002)	1 (.002)	.999 (.001)
Impulsiveness	**1.106 (.039)****	**1.092 (.039)***	1.012 (.012)
Mental Health Continuum	.978 (.032)	.975 (.033)	1.003 (.014)
Satisfaction with Life	.945 (.114)	.996 (.116)	.948 (.039)
Self-esteem	.935 (.113)	.941 (.116)	.994 (.033)
Social Alienation	.917 (.071)	.913 (.073)	1.005 (.020)
Time Spent playing games	1.288 (.370)	.902 (.375)	**1.428 (.114)****
Sex	1.365 (.752)	4.077 (.776)	**.335 (.258)*****
Problem Gambling	**4.112 (.385)*****	**4.847 (.408)*****	.848 (.190)
Gaming Motivations			
Competition	1.026 (.161)	1.048 (.162)	.979 (.038)
Escape	.669 (.207)	.681 (.209)	.984 (.055)
Social	1.091 (.126)	1.002 (.127)	1.089 (.044)
Cope	1.270 (.228)	1.253 (.229)	1.014 (.054)
Recreation	**.573 (.187)****	**.492 (.189)*****	**1.165 (.043)*****
Skill Development	.931 (.143)	.916 (.145)	1.017 (.037)
Fantasy	1.177 (.184)	1.288 (.186)	**.914 (.042)***

*** Significance at $p < 0.001$, ** Significance at $p < .01$, *Significance at $p < .05$

Class 1 = cross-platform “gambling gamers”; Class 2 = “F2P” gamers; Class 3 = “non-F2P” gamers