A Validation Study of the 'Problem Video Game Playing Test' (PVGT) in an Undergraduate University Sample

by

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Abstract

There is a growing amount of attention being given to the subject of problem video game playing, however there is currently a lack of consensus regarding the measurement and assessment of problem video game playing. This paper validates the Problem Video Game Playing Test (PVGT) for use in an undergraduate university sample. An exploratory factor analysis on the PVGT index items, in conjunction with bivariate analyses with known correlates to the concept of problem gaming suggests the PVGT is a strong measure of problem online video gaming. Subsequent regression analysis suggests that problem online video gaming is associated with average length of time spent gaming, gaming motivations (including competition, escape, cope, social, recreation) and social alienation. Concepts related to problem gambling (including depression, anxiety and stress) are not indicative of problem gaming, and the implications of this analysis are discussed.

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Dedication

To my partner, Jasmine, and my daughter, Terra, without whom this would not have been possible.

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Chapter 1: Introduction

The market for video 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, Delfabbro, & Griffiths, 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 hobby, 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). 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.

The video game industry is a significant source of consumer spending, where video game consumers spent approximately USD 26.5 billion dollars in 2015 on video games and related hardware (Entertainment Software Association, 2016). Over the past five years, there has been a dramatic shift in consumption patterns from physical software products (Video game disks, etc.) to digital products (downloadable software). Additionally, the generation of individuals known

as ‘millennials’ (persons born between the early 1980s and 1990s) tend to spend more money online for various product types, as online shopping and digital consumption suit the retail preferences of these individuals (NPD Group, 2017).

With the shift toward utilizing digital goods and an increase in the number of individuals who consume those goods, it is important to turn attention to the problematic aspects that are related to this consumption. Companies that operate within the video game industry seek to capitalize on the increase in digital consumption, and have thus introduced new methods to entice consumers to their product (Choi & Kim, 2004). This has led to the introduction of ‘micro-transactions’, small purchases that may enhance the aesthetic or other aspects of gameplay, and ‘downloadable content’, which is often a larger expansion of the game and frequently necessary for individuals who want to “multiplay with friends” and “[have] all the game content” available to them (The NPD Group, 2016a).

Ways of interacting with the games have also increased in recent years. The rise of eSports (electronic sports), where professional video gamers compete with others (or other teams) in a video game environment has developed alongside video game streaming, where individuals can log in to a website and watch someone play their favourite video game. In a survey conducted by the NPD group (2016b), among gamers who played an average of three hours per week, forty-four percent had reported watching an eSports or video game streaming event in the past six months. This provides gamers with another way in which they can immerse themselves in the video gaming environment.

Rising alongside the rapid expansion in the video game environment and associated video game media forms are concerns about problem video gaming. Evidence suggests that video games “can … become addictive” and detrimental to other aspects of players’ lives (King et al.,

2013, p. 819). Although the concept of video game addiction as a disorder is often criticized, there is a significant body of research that investigates the existence and nature of problem gaming. Indeed, there still is no consensus on what exactly constitutes a video game addiction, or how one would diagnose such a disorder (Petry, Rehbein, Ko, & O'Brien, 2015; Petry et al., 2014; King et al., 2013; Desai, Krishnan-Sarin, Cavallo, & Potenza, 2010). While several models of game addiction have been proposed, it is still an area in need of research in order to expand our understanding of this behavioural addiction.

There is also a concern that problem 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. For example, mood disorders 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 et al., 2015; Petry et al., 2014; King et al., 2013.) Motivations to gamble, such as coping with mood disorders, 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). 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).

Given the rapid emergence of video gaming and its potential harmfulness, this study proposes to add an important component to the research literature. Specifically, this study 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 will be accomplished in stages; 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 stage, 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.

This project begins with a review of existing literature on the characteristics of pathological video game play and pathological gambling. This review allows for an exploration of common factors which place individuals at a higher risk of developing pathological video gaming and/or pathological gambling. This project then provides an overview of the Self-determination theory, the conceptual framework that situates our approach. Self-determination theory is a valuable framework for understanding how video gaming can become problematic and/or addictive. Then a number of hypotheses, some replicated from the original validation study, and others added based on the literature review, will be tested.

Hypotheses are followed by a discussion of the methodology utilized in this research project. This section describes the sample of Canadian university undergraduates from whom data were collected, the specific measures of all the independent and dependent variables used in the analysis, and a description of the statistical analysis procedures used to conduct the validity test. The results section presents the univariate descriptors for the items utilized in the OLS regression model, the outcomes of the exploratory factor analysis, in addition to bivariate and multivariate analysis. This allows for a discussion of the performance of the PVGT in terms of its structure and construct validity, and the relationship of items to the PVGT. Finally, limitations of this project are outlined, as well as potential for future research.

Chapter 2: Review of the Literature

Characteristics of Video Gamers

Social connectedness. As use of the internet for online games has grown, video-gaming has become an increasingly social pastime (Domahidi, Festl, & Quandt, 2014). In fact, "most digital game users are engaged in social gaming" (Domahidi et al., 2014, p. 107). Heavy video game use is often discussed in the context of "social isolation", which is further compounded by the primacy given to friendships formed in the real world as opposed to those developed in a digital game world (Domahidi et al., 2014, 108; Przybylski et al., 2010). Importantly, digital interaction makes social interaction possible for individuals who may otherwise find it difficult to interact with others in the physical world, for example those individuals with physical disabilities. (Domahidi et al., 2014).

Previous research into social connectedness and isolation related to online video game use has produced mixed results. One the one hand, there is the perspective that playing online video games often results in individuals participating in an activity together but with minimal interaction (Domahidi et al., 2014; Ducheneaut, Yee, Nickell, & Moore, 2006). Digitally formed relationships are frequently viewed as less meaningful than real-world friendships, and are described as "auxiliary relationships" (Domahidi et al., 2014, 108; Mesch & Talmud, 2006). This perspective suggests that while individuals play together, there is little room to develop meaningful social connections. This understanding of social interaction in online games, however, may neglect the changing media environment within which individuals can interact and how they do so with the development of internet technologies.

Importantly, as the internet has continued to permeate the social world, individuals are spending greater amounts of time interacting with others through digital platforms, whether they are social media networks or video games (Domahidi et al., 2014). The internet, and the games played online, have allowed individuals to interact across national borders, and it is important not to devalue the potential for social interaction and connectivity in this era of internet proliferation.

A common perception of video gamers is that the time they spend playing video games comes at the cost of social connections outside of the game world (Colwell & Kato, 2003). In a study that explored youth video-gaming in Japan, Colwell and Kato (2003, p. 153) found that there was no significant relationship between having "good friends" and playing computer games. Participants of this study were Japanese junior high school students between the ages of twelve and thirteen. Thus, children appear to form social connections regardless of their computer video game playing.

Self esteem. Another concept often explored related to individuals who play video games is self-esteem. While research into this concept as it applies to video gamers has led to mixed conclusions, on one hand, there is good reason to think that self-esteem is negatively linked to video game play (Colwell & Kato, 2003). On the other hand, some studies have found that self-esteem and video-game use are unrelated (Colwell & Kato, 2003). It is important to note the difficulty of directly comparing the results of different studies exploring the self esteem-video game playing relationship as they have used different measures of self-esteem (Colwell & Kato, 2003).

Life satisfaction and well-being. Like self-esteem, there is evidence to suggest that excessive video game playing is associated with lower life satisfaction and overall well-being (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 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.

Video Game Addiction

At this point, it is helpful to outline a definition of video game addiction. First, addictive video gaming is often referred to as problematic or problem video gaming (Desai et al., 2010; King, Delfabbro, & Zajac, 2011). The term *problem* thus is applied to video gaming despite the fact that measures of problem gaming are frequently adopted from the diagnostic criteria for *pathological* gambling, which emphasizes the "urges" and "relief" experienced before and after participation in a pathological activity (Desai et al., 2010, p. 1415). At a most basic level, addictive video gaming is characterized by a compulsive need to play games that extends beyond a pleasurable desire to play (Lemmens et al., 2009). This is similar to a general understanding of "addictive behaviour" which is characterized by a "persistent and uncontrollable urge to consume a substance or engage in an activity that results in significant personal harm and interpersonal conflict" (King et al., 2013, p. 820). The compulsive drive to play video games may result in harm to the individual playing, often perceived as negatively impacting the social or economic well-being of the problem video gamer. It ceases being a desire to play and takes on an uncontrollable element where the video game player *must* play. King and colleagues (2013, p. 819) provide a more concise definition of addictive video gaming, where "[v]ideo game

addiction refers to the persistent and maladaptive pattern of video game playing behavior". Such an addiction is seen as a "technological addiction" that has "addictive effects" for certain groups of gamers (King et al., 2013, p. 819). Currently, there is no consensus on how to classify, and whether it should be classified, technological addictions such as video game addiction. This has contributed to difficulties in establishing accurate prevalence rates of problem video gaming (Desai et al., 2010).

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, Rehbein, Ko, & O'Brien, 2015, p. 1). Interestingly, while some measures of addictive video game playing are adapted form 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).

Although the DSM-5 indicates that further research is required to conclusively define addictive video game playing as a disorder, researchers have made progress in outlining general criteria which can characterize video game addiction. King and colleagues (2013, p. 820) outline a six-component model for video game addiction that includes "salience", "mood modification", "tolerance", "withdrawal", "relapse", and "harm". Together, individuals who experience a combination of these factors in the context of video game play over several months can be said to meet the criteria for a video game addiction diagnosis (King et al., 2013).

Salience or "preoccupation" occurs when playing video games becomes an individual's primary activity, permeating their thoughts and occupying their emotions (King et al., 2013; Petry et al., 2015, p. 2). The period between game sessions is filled with thoughts related to video games and a desire for the next gaming session. *Mood modification* relates the physiological changes that occur in the addicted individual as a result from playing video games, and may include arousal, excitement, calmness, and agitation among others. *Tolerance* suggests that in order to fulfill an increasing desire to play video games, the length of video game sessions are often expanded. In addictive play, it is possible that the game session finishes only when the addicted player is too "mentally or physically exhausted" to continue (King et al., 2013, p. 820). *Withdrawal* refers to the negative feelings and emotions that occur between gameplay session, or that might result from a sudden cessation of a gaming session (King et al., 2013; Petry et al., 2015). *Relapse* occurs when, after a period of "abstinence", and addicted gamer easily falls back into problematic video-gaming patterns, and suggests a loss of control over one's behaviour (King et al., 2013, p. 820). Finally, *harm* relates to the negative social, economic, and personal consequences that occur as a result of addictive video game playing. Importantly, the DSM-5 criteria for internet game disorder expand on the criteria for harm by exploring how addicted individuals conceal their activities, or use the activity of gaming as a means of forgetting "real-life problems" (Petry et al., 2015, p. 2).

While internet gaming disorder implies a specific condition related to online gaming, it is important to recognize that the DSM-5 extends its application to offline, console, and myriad of other forms of video game play (Petry et al., 2015). Thus, internet gaming disorder refers to addictive video game play across all forms, online and offline. The use of the word internet, therefore, is used to distinguish pathological video game play from gambling addiction (Petry et

al., 2015). That is to say, the term ‘internet’ serves to separate video gaming disorder from the established gambling disorder (and substance abuse), since internet gaming disorder at present lacks rigorous and reliable diagnostic criteria (Petry et al., 2014).

Video game addiction may be encouraged through the particular design or genre of video game. For example, players of online games such as *World of Warcraft*, which uses a massively multiplayer online (MMO) design, are exposed to seemingly boundless gameplay, where one can continue playing for an indeterminate amount of time without pauses or breaks (King et al., 2013). In some cases, researchers have developed video-game specific or genre-specific criteria for assessing problematic play. For example, the Addiction-Engagement questionnaire was developed specifically for players of the MMO-style game Asheron’s Call (Charlton & Danforth, 2007).

Some characteristics stand out when we focus on video-gamers who can be said to be addicted to gaming. Given the finding that individuals who are reportedly addicted to the internet are less sociable than the non-addicted, it seems plausible that this negative association might also extend to video game addiction (Lemmens et al., 2009). In fact, some studies have shown a lower degree of sociability is characteristic of addicted computer video game players (Lemmens et al., 2009). Problem video gamers, therefore, seem to have a lower degree of offline social connections than individuals who are not problem gamers.

Related to lower sociability among problem video gamers is the experience of loneliness. In studies that explored the concept of internet addiction, loneliness appears to be positively related to addictive internet use (Lemmens et al., 2009). Thus, individuals who are described as internet addicted report having a higher degree of loneliness than those without internet addiction (Lemmens et al., 2009). Furthermore, studies have shown that feelings of loneliness are highly

predictive of problematic video game use, suggesting that addictive video game play is emblematic of loneliness (Lemmens et al., 2009).

Characteristics of Gamblers

Gambling and associated games are among the most financially successful industries, and for many are a source of fun and entertainment. Importantly, there is a small segment of the population that gambles compulsively, for whom gambling devolves beyond entertainment into harm (Gupta, Derevensky, & Ellenbogen, 2006). Furthermore, opportunities for gambling have multiplied greatly through the development of the internet. Compared to offline gamblers, online gamblers have distinct characteristics and gambling preferences, with one study suggesting the existence of a higher prevalence of problem gambling among online gamblers (Wood & Williams, 2011). Many individuals who gamble online also gamble offline, suggesting that many gamblers take advantage of the increased access to various gambling forms (Griffiths & Kuss, 2015).

Importantly, pathological gamblers are frequently described as having higher rates of mood disorders than the non-pathological gambling population (Martin, 2008; Black & Moyer, 1998; Becona, Lorenzo, & Fuentes, 1996). Often, depression and anxiety are discussed and referred to as risk factors for the development of pathological gambling (Blaszczynski & Nower, 2002). Additionally, pathological gamblers frequently score higher on measures for impulsiveness and psychopathy, suggesting a higher prevalence of these mood disorders among gambling addicts (Blaszczynski, Steel, & McConaghy, 1997; Blaszczynski & Nower, 2002). Thus, mood disorders remain a central factor associated with pathological gambling.

In a study which explored the differences between online and offline gamblers, Wood and Williams (2011) found that internet gambling was more prevalent among younger gamblers. This study compared the survey results of 1954 internet-based gamblers with those of 5967 non-internet gamblers, with the goal of uncovering the differences between these two populations of gamblers. Internet gambling was more common among males, a finding that is consistent with other research on internet gambling (Wood & Williams, 2011). Importantly, substance abuse was a predictor for internet gambling, suggesting a higher level of substance use (tobacco, alcohol, and illegal drugs) among the internet gambling population (Wood & Williams, 2011). Ultimately, the authors found that problem gambling was between three and four times higher among internet gamblers when compared to non-internet gamblers (Wood & Williams, 2011). Importantly, internet gamblers in this study reported using an average of four differing forms of gambling including online and offline sources, whereas non-internet gamblers reported using an average of two and a half different gambling forms. Importantly, Griffiths and Kuss (2015) found that pathological gambling was non-existent among internet-only gamblers in their sample. Thus, while online gamblers utilize an increasingly diverse gambling market, the relationship between online gambling and pathological gambling requires further exploration.

Gambling Addiction

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).

Unlike internet gaming addiction, gambling addiction remains recognized as a disorder in the DSM-5 due to its similarities with substance addictions (Petry et al., 2015). It should be noted, however, that, as with internet gaming disorder, there is still much research taking place in attempt to define what exactly constitutes gambling disorder. Defining pathological gambling has been challenging, as some researchers have focused on the disorder as a substance addiction, whereas others have pointed to addictive gambling's similarities with other disorders, such as obsessive compulsive disorder (Blanco, Moreyra, Nunes, Saiz-Ruiz, & Ibanez, 2001). As a result, several models exist which attempt to explain gambling addiction, and researchers hold divergent views related to the population of pathological gamblers (Blaszczynski & Nower, 2002). Furthermore, difficulties arise when individuals who are not gambling addicts are

mistakenly grouped with pathological gamblers. Blaszczynski and Nower (2002, p. 488) state that when this error occurs "[g]amblers experiencing gambling related problems are misclassified as those who are unable to control and regulate impulses to gamble" and can negatively impact our understanding of pathological gambling and how to treat and prevent it.

Similar to King and colleagues' (2013) definition of video game addiction, Blaszczynski and Nower (2002, p. 487) use the American Psychological Association's definition of pathological gambling to analyze how individuals become gambling addicts:

> "Pathological gambling is defined as 'persistent and recurrent maladaptive gambling behaviour' characterized by an inability to control gambling, leading to significant deleterious psychosocial consequences: personal, familial, financial, professional and legal."

Thus, gambling addiction is seen as compulsive behaviour that can have severe negative consequences for an individual in all facets of life. Additionally, a pathological gambling diagnosis requires an inability to cease or resist gambling when one "genuinely" wants to, suggesting an inability for the individual to control their gambling behaviour (Blaszczynski & Nower 2002, p. 488).

Mood disorder. There is also 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.

Impulsiveness. Another behaviour which is related to pathological gambling is impulsiveness. 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). Impulsivity is often associated with antisocial personality disorder and psychopathy, which are also linked to addictive gambling (Blaszczynski et al., 1997, p. 85). Thus, impulsivity is an important concept that relates to pathological gambling.

Prevalence of problem gambling. It is entirely possible that the prevalence rate of problem gambling is underestimated in society. Many individuals do not discuss gambling activities with a doctor who is capable of diagnosing an addiction (Martin, 2008). Unlike other disorders, there are no specific visible traits associated with problem gambling. Additionally,

problem gambling can have a significant social impact. Problem gambling can lead to marital problems, social problems, and financial difficulties, but may remain invisible as a cause (Black & Moyer, 1998). One study found that individuals with problem gambling behaviours were twice as likely to have suicidal thoughts, and were higher risk for drug abuse (Martin, 2008). Disordered gambling is a significant health concern, and has serious social consequences.

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 online only may be resistant to certain factors that contribute to problematic gambling behaviour, although more research into this finding is necessary.

What distinguishes problem gamblers from problem video gamers?

In recent years, there has been an increasing interest in developing and marketing skill-based gambling systems in order to capture the emerging generation of video-gamers. For example, the state of Nevada has positioned itself as a leader in the use of this emerging technology. Specifically, new legislation in Nevada encourages gaming manufacturers to develop skill-based gambling systems that will target a younger generation of technically savvy individuals (St. Martin, 2015). With the rise of skill-based gambling systems, there is a need to empirically examine the link between online video-gaming and gambling activities.

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.

There exists debate about whether problem video-gaming and problem gambling are linked (Desai et al., 2010). Research that considers "pathways" that lead individuals into becoming pathological gamblers focus upon social and personality based traits that predict problematic gambling behaviour (Delfabbro, King, Lambos, & Puglies, 2009; Blaszczynski & Nower 2002, p. 487). Importantly, Delfabbro and colleagues (2009) suggest that for youth, experiences with video game technologies that share similarities to gambling systems lead to familiarity with gambling systems before they are legally able to gamble.

Recently there has been a "convergence of gambling and digital media", where gambling elements are increasingly present in video games across the platforms in which they are played (Delfabbro et al., 2009, p. 392). The use of online computers, consoles and mobile phones have not only increased users' ability to access online gambling websites, but video games played on these platforms have increasingly incorporated "virtual casino" style mini-games (Delfabbro et al., 2009). Exposing youth to gambling systems in video games can make youth "receptive" to gambling activities when they are older, potentially making gambling a more attractive form of entertainment (Delfabbro et al., 2009, p. 392). This is compounded by the physical similarities that are common between gambling and video game systems.

Video games share many "structural" similarities with gambling systems (King et al., 2013; Delfabbro et al., 2009, p. 393). 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.

Two significant factors that have been identified in their relationship to problem video gaming and gambling are depression and anxiety (Delfabbro & King, 2015). Mood disorders 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 mood disorders 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".

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.

Due to the many similarities disordered gambling and disordered video gaming share, it is no surprise that the diagnostic criteria researchers suggest for pathological video gaming overlap with the criteria for gambling disorder. If an individual gamer experiences the core categories related to pathological gaming (salience, mood modification, tolerance, withdrawal, relapse, and harm) "continuously for three to six months" then they can be said to have a pathological video game disorder (King et al., 2013, p. 820). According to the DSM-5, an individual can be diagnosed with gambling disorder if they have four out of nine of the following factors related to problem gambling within a period of twelve months: preoccupation with gambling (salience), a need to gamble with increasing amounts of money, inability to reduce gambling activity or stop, restlessness or irritability results from attempts to cease gambling, gambling is used to dissociate, attempting to recover from losses, lying to conceal gambling activity, negative social consequences as a result of gambling, and/or relied on outside sources to

fund gambling activities (Stinchfield et al., 2016). While there is emphasis on economic losses for a gambling disorder diagnosis, there is clearly an overlap in the other diagnostic criteria regarding preoccupation with the activity, withdrawal and cessation effects, dissociation and escape, and negative social consequences that result from the addictive activity and compulsive behaviour that results. One significant difference between problem gambling and problem video gaming, however, is the currency through which one participates in their activity. Whereas the gambler requires additional sources of money to continue their activity, video gamers require longer periods of time to continue in theirs. Irritability that occurs when gamblers cannot fund their gambling activity occurs in video gamers when they cannot satisfy their preoccupation with video games by sitting down and playing (Delfabbro et al., 2009).

The amount of time individuals spend gaming has historically been a central concern related to addictive video gaming behaviour. As noted, where gamblers invest money in order to continue their activity, video gamers "invest time" to become better at the game and prolong play (King et al., 2013; Przybylski et al., 2010, p. 156). While the length of time an individual spends on video game related activities is an important indicator of video game addiction, it is important to acknowledge that it alone does not classify one as an addicted gamer. However, we can expect that individuals who are addicted to video games will play more frequently and for longer periods than a typical video game player (Lemmens et al., 2009).

Mapping the Dimensions of Problematic Video Gaming

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.

There is a growing body of research that seeks to understand the heightened prevalence of online video gaming by focusing on how it satisfies certain "human needs" (Przybylski et al., 2010, p. 155). This approach views satisfaction of human needs or motives as a significant motivational force that attracts individuals to online video games. Motivations drive behaviours by tying certain acts or activities with "emotional preferences" (Demetrovics et al., 2011, p. 814). Video games, from this perspective, are viewed as a stimulus that improves "short-term well-being" by "satisfying universal psychological needs" (Przybylski et al., 2010, p. 157). In previous studies looking at game popularity in relation to needs satisfaction, Przybylski and colleagues (2010, p. 157) found that video game popularity is "directly associated" with the various needs that are satisfied through interaction with that game. Thus, the more poplar a video game is, the greater its capacity to satisfy a wider range of psychosocial needs. Furthermore, problematic or compulsive video game playing is less likely to occur when a variety of needs are already met through an individual's regular everyday life (Przybylski et al., 2010). Compensatory satisfaction of psychosocial needs, therefore, plays a significant role in motivating individuals to play online games.

Importantly, researchers have began exploring what factors motivate individuals to play video games. 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. Thus, 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).

Escape. Similar to gambling, one reason why individuals may be motivated to play video games is to escape one's reality and the problems one might have (Demetrovics et al., 2011). Much like gamblers who participate in gambling activities as a means of escaping from reality (Gambling Treatment Helpline, 2015; Blaszczynski & Nower, 2002), many video gamers turn to video games as a means of escaping from the problems found in everyday life (Demetrovics et al., 2011). By providing individuals with a distraction from reality, video games allow people to escape into a virtual world where an individual can displace thoughts related to the negative aspects of reality.

Coping. Unlike the escape motivation, which focuses on escape from everyday problems in the physical world, the coping motivation focuses on how individuals use video games as a means of alleviating feelings from negative moods, while possibly improving one's mood (Demetrovics et al., 2011). As with the escape motivation, coping as a motivational force is similarly explored in research into both problem gambling and problem gaming (Sim et al., 2012). Thus, this coping factor relates to individuals who are motivated to play video games through a desire to cope with distress and/or negative feelings

Recreation. One of the most often cited reasons to play video games is because they provide entertainment (Demetrovics et al., 2011; Przybylski et al., 2010). By providing users with an alternative to movies and other entertainment forms, video games are often played simply because they are "fun" (Przybylski et al., 2010, p. 154). User interactions with video games, however, are not so simple. Przybylski and colleagues (2010, p. 155) describe gamers as "intrinsically motivated," and suggest that video-gaming satisfies three basic psychosocial needs for gamers: a sense of "competence", a sense of "relatedness", and a sense of "autonomy". By drawing on these human needs, video games are able to attract an audience through "tapping" into our natural "motivational processes" (Przybylski et al., 2010, p. 155). Furthermore, video games can become significant forces in gamers' lives, where many gamers may delay or forego offline opportunities to spend significant amounts of time participating in online gaming activities (Przybylski et al., 2010). While online gaming may be conceived of as a social activity, many individuals sacrifice personal social connections for their gaming activities.

Recreation may be the strongest motivation for online video game playing (Demetrovics et al., 2011). One of the reasons for "excessive" gameplay, among others, is simply that games are a source of "fun" (Mitchell & Savill-Smith, 2004, p. 9). Video games frequently have an

objective that is to be met, or goals that a player is to strive toward. To keep players enjoying a video game, they must be challenged and motivated to learn the ways in which they can overcome those challenges. Fun is an important concept, because fun is considered an integral aspect related to human learning (Mitchell & Savill-Smith, 2004). Thus, by challenging users in a manner they consider pleasurable or fun, video games are designed in a way that uses 'fun' as a driving motivator behind keeping players involved with the game.

Social. The social aspect of gaming is a significant motivation for playing online games (Domahidi et al., 2014). Demetrovics and colleagues (2011) suggest that the social motivation is the second strongest motivation for online gaming. Certainly, before the internet, communities formed around arcade gaming, however the internet and online games have expanded the ability for communities to form around certain games (Przybylski et al., 2010; Domahidi et al., 2014). Online games create a "virtual world" where users can interact in cooperative and/or competitive ways (Przybylski et al., 2010, p. 156). In massively multiplayer online games, players are able to form, maintain, and join groups of other players, referred to as "guilds" or "clans", that have a particular relationship to these cooperative and competitive elements within these games (Przybylski et al., 2010, p. 156). While previous perspectives on social interaction within online games suggested that such relationships may be superficial and less meaningful than real world relationships, there is a growing body of evidence to suggest that gamers seek and form meaningful social connections through their interactions in online video games (Domahidi et al., 2014; Demetrovics et al., 2011; Przybylski et al., 2010; Ducheneaut, Yee, Nickell, & Moore, 2006).

In their study on Japanese youth video-gamers, Colwell and Kato (2003) explored the question of whether computer games were supplanting real-life friendships. Thus, Colwell and

Kato (2003, p. 156) asked whether computer games "fulfil similar needs to those provided by real friends". They found that individuals who felt a preference for video games over playing with friends frequently played video games for larger amounts of time (Colwell & Kato, 2003). However, these same individuals did not report having less real-life friends than those who do not prefer computer play over friendship (Colwell & Kato, 2003).

Many individuals play online video games as a way to interact with other people, and research indicates that frequency of online video game playing is positively related with the possibility of making online friendships (Domahidi et al., 2014). Domahidi and colleagues (2014, p. 113) found that "[o]nline gamers with a pronounced motive of searching for social capital and teamplay had a higher probability of meeting originally online friends personally". Thus, online games provide a rich source of social interaction and allow for the formation of meaningful friendships for those who actively search for such relationships.

Fantasy. The fantasy motivation refers to the motivation to place yourself into another world where the player can use their imagination to place themselves within a virtual game world (Demetrovics et al., 2011). "Immersion" plays a significant role in successfully creating a vivid fantasy capable of captivating the player in a fantastical setting (Przybylski et al., 2010, p. 161). To successfully motivate a player to participate in an online gaming universe, the player "must feel embedded in the virtual environment and the story happening there" (Przybylski et al., 2010, p. 161). Przybylski and colleagues (2010, p. 161) describe three aspects related to fantasy motives for playing games, "physical presence", "emotional presence", and "narrative presence". Together, these factors suggest that successful immersion in a fantasy world means that players are able to place their self within the game world and are emotionally attached to the events taking place in the world in addition to the main story being told. In this sense, the game must

captivate the player and draw their undivided attention, allowing them to successful transport their imagination into the game world.

Competition. By providing users with an ascending system of challenges, individuals are presented with increasing levels of personal satisfaction related to their in-game accomplishments (Przybylski et al., 2010). Video games carefully balance challenges to the skill level of users, so as to reduce feelings of frustration (Przybylski et al., 2010). While gamers receive satisfaction through their feelings of competence as they complete challenges, online games present an environment where those challenges put gamers into competition with one another. By providing users with rewards for completing certain challenges, gamers can distinguish themselves in various ways, and this competition motivates users to continue playing (Demetrovics et al., 2011; Przybylski et al., 2010).

Skill development. The need to feel competent also provides users with a motivation to develop their skills in order to become better at the game they play. Przybylski and colleagues (2010, p. 156) state that gamers seek "mastery of controls" as it is a necessary condition for "need-satisfying play". Online video games all have a "learning curve", understood as the amount of time and effort required by users to master the game, where games that are highly complex are described as having a "steep" learning curve (Przybylski et al., 2010, p. 156). Developing the skills to compete within a steep learning curve online video game can be highly rewarding, and allows participants to compete at more challenging levels within the game.

Measures of Disordered Video Gaming

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). 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).

Game addiction scale. One proposed measure for addictive video gaming behaviour is the Game Addiction Scale (GAS) (Lemmens et al., 2009). By adapting the "DSM's pathological gambling criteria to measure addiction to (online) games", Lemmens and colleagues (2009, p. 79) developed a twenty-one-item questionnaire which attempted to measure to concepts of Salience, Tolerance, Mood modification, withdrawal, relapse, conflict, and problems. Since the structure of DSM criteria video game addiction measures had not previously been examined, Lemmens and colleagues (2009) sought to explore the GAS using structural equation modelling

and found a good fit for their model, which was supported by a high degree of internal consistency (Cronbach's alpha = .94 and .92 in the two samples explored). Thus, the GAS is proposed as a strong measure for video game addiction.

Addiction-engagement questionnaire. For the purpose of measuring addictive video gaming, Charlton and Danforth (2007) recruited 442 participants who played the online video game *Asheron's Call*. Using this sample, Charlton and Danforth (2007, p. 1536) developed the "Addiction-Engagement questionnaire" (AEQ) specifically for Asheron's call, and measured addictive play using a twenty-nine-item survey which measured two factors, addiction and engagement. Using Principal Axis Factoring to analyze the construct of the AEQ, Charlton and Danforth found that the two factors accounted for only thirty-two percent of the variance in the items. Additionally, none of the individuals in the study were classified as addictive gamers based on their survey results.

Online game addiction index. Using a sample of Chinese college students, Zhou and Li (2009) outlined the Online Game Addiction Index (OGAI), which was purposefully designed to measure problem video gaming in mainland China. This twelve-item scale measured three factors the authors determined, through a review of literature, were related to problematic video gaming: "Control Disorder", "Conflict", and "Injury" (Zhou & Li, 2009, p. 151). The indices that measured 'Control Disorder' (Cronbach's alpha = 0.82), Conflict (Cronbach's alpha = 0.87) and 'Injury' (Cronbach's alpha = 0.75) displayed a good degree of internal consistency. The authors recommend using this scale outside of China in other societies as a means of understanding video game addiction.

Internet gaming disorder. Included in the DSM-5 are the proposed diagnostic criteria that describe Internet Gaming Disorder (IGD). While other measures use a scale measure, the

IGD criteria involve yes or no answers to nine questions which measure each factor related to an individuals' video game playing: "Pre-occupation", "Withdrawal", "Tolerance", "Reduce/Stop", "Give up other activities", "Continue despite problems", "Deceive/cover up", "Escape adverse moods", "Risk/lose relationships/opportunities" (Petry et al., 2014, p. 1401). Importantly, the IGD is proposed as a disorder in need of further research, and while the proposed cut-off for diagnosis is five of the above criteria for a period of twelve months, the "optimal" criteria for IGD diagnosis remain ambiguous (Petry et al., 2014, p. 1404; Kaptsis et al., 2016).

To apply the DSM-5 criteria for IGD, Pontes and colleagues (2014) utilized the IGD-20 test among 1003 participants who were recruited through various gaming forums. The IGD-20 attempts to measure Griffith's (2005) six components model of addiction: salience, mood modification, tolerance, withdrawal, conflict and relapse (Pontes et al., 2014). The IGD-20 displayed a high level of internal consistency (Cronbach's alpha = 0.88), and confirmatory factor analysis revealed loadings that supported a six-factor solution. While the results from this study are promising for the development of a tool for measuring IGS, the authors discuss the limitations associated with their use of a convenience sample, and recommend further research that utilises representative samples (Pontes, Kiraly, Demetrovics, & Griffiths, 2014).

Recently, Lemmens, Valkenburg, and Gentile (2015) have developed the Internet Gaming Disorder Scale (IGDS) to reflect the DSM-5 criteria for IGD. This is a twenty-seven-item scale, where each of the nine components of IGD are measured using three questions. Thus, this scale measured the concepts of preoccupation, tolerance, withdrawal, relapse, escape, problems, deception, displacement, and conflict as they relate to IGD. In their study, Lemmens and colleagues (2015) found that the IGDS displayed a good fit for measuring IGD and had a

high internal consistency (Cronbach's alpha = 0.83). Additionally, a shortened nine-item scale was explored with similar results.

Problem video game playing test. In order to analyze a general problematic form of video game playing, King and colleagues (2011) proposed the use of the Problem Video Game Playing Test (PVGT). In contrast to the previously discussed indices designed to measure pathological or addictive video gaming, 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.

Theoretical Framework

This project is informed by "self-determination theory" which has its roots in social psychology (Deci & Ryan, 2011, p. 416). This theoretical perspective emphasizes the impact of the "social environment", which includes "people's attitudes, values, motivations, and behaviours", on individual perspectives and associated "outcomes" (Deci & Ryan, 2011, p. 416). The social environment affects individuals both developmentally and continuously, meaning that if attitudes within the social environment shift, individuals within that social environment can adopt that change in perspective as well. Thus, individuals learn what is important from the social environment in which they exist through their interactions within that environment, regardless of their developmental stage (Deci & Ryan, 2011).

Self-determination theory also emphasizes that individuals are the primary drivers of their own learning experience as they navigate the social environment. How we navigate the social environment has a 'natural' element to it; humans are "inherently active, intrinsically motivated, and oriented toward developing naturally through integrative processes" (Deci & Ryan 2011, p. 417). Many aspects of how/what we learn from the social environment derive from humans' natural learning and understanding processes. However, learning itself is a developmental process that occurs throughout human life, and while there is a natural intrinsic element to learning, the learning process is affected by social environments. If individuals are not

properly motivated or integrated into the social environment, then social learning may be "impaired", resulting in sub-optimal outcomes regarding development and subsequent behaviours (Deci & Ryan 2011, p. 417). Therefore, individuals must be motivated to learn and be involved in the social environment, and a lack of such motivation leads to outcomes not consistent with the social environment. This is problematic, because it leads to individuals not being invested or engaged within a community, and can lead to maladaptive behaviour.

Behaviour is an important part of self-determination theory. Self-determination theory conceptualizes behaviours and choices as "the most serious threats to physical health", and has been applied as an analytical tool for understanding substance abuse (Deci & Ryan 2011, p. 430). Przybylski and colleagues (2010, p. 155) employed self-determination theory and the associated sub-theory "cognitive evaluation theory" to understand how needs and motivations relate to video gamers, and suggest that individuals seek out video games as a means of satisfying basic human needs. Thus, problematic video gaming behaviours may occur as a result of seeking needs satisfaction outside of the real world, and inside the worlds of video games.

Self-determination theory suggests that there are "three universal psychological needs" that are necessary for human "development and functioning" (Deci & Ryan 2011, p. 417). Importantly, Self-determination theory suggests that these needs are met through interactions within the social environment (Przybylski et al., 2010). Humans strive to satisfy the need for "competence, autonomy, and relatedness" in order to achieve successful "development and functioning" (Deci and Ryan 2011, p. 417). *Competence* refers to one's desire to feel capable and skillful, while *autonomy* refers to one's sense of being in control and having choice. *Relatedness* refers to the human desire to interact with others socially, or a need for "social connectedness"

(Przybylski et al., 2010, p. 155). Satisfying these universal human needs becomes a key motivational force animating human behaviour.

This project complements self-determination theory with cognitive-behavioural concepts. Cognitive-behavioural theory will help conceptualize the connection between mood disorder and behavioural disorders such as gambling addiction. The cognitive behavioural framework holds that human behaviours are learned through our interactions with others and are reinforced through our mental cognitions (Center for Addiction and Mental Health, 2015). This means behaviours are fortified by our interpretations of our feelings and the events we experience. Importantly, the cognitive behavioural approach helps synthesize theories that have typically focused on either the cognitive or the behavioural aspects of individuals (Treasure, Schmidt, & Furth, 2005). According to the cognitive behavioural model, problematic behaviours (e.g. pathological gambling behaviours) are learned and reinforced through rewards, such as physiological excitement (Sharpe & Tarrier, 1993). As these behaviours become associated with feelings of relief (perhaps from mood disorders), the individual seeks out those activities where the behaviour alleviates or masks those negative emotions. Simply put, the cognitive-behavioural model suggests that gambling disorder or pathological gaming is a learned behaviour that may displace the negative feelings associated with mood disorders such as depression or anxiety, even if only temporarily.

The concept of comorbidity applies also to the topic of pathological behaviour and mood disorder. Comorbidity refers to the fact that two disorders may co-occur in the same person, and that they may interact in such a manner that they can "worsen the course of both" (National Institute on Drug Abuse, 2012, para 1). This suggests that depression and anxiety may simultaneously be present in the gambling addict, worsening the addictive behaviour while

creating a feedback loop that in turn exacerbates feelings of anxiety and depression. This illuminates a significant difficulty related to the cognitive-behavioural model, in that it is unclear whether pathological behaviour results from, or allows for, the development of mood disorder. Thus, the proposed research will also consider addiction from a mental health perspective that acknowledges the complex interplay of co-occurring disorders and how this can affect individuals vulnerable to such comorbidity—particularly problem online gamers with problematic gambling and/or mood disorders.

One major assumption of the cognitive-behavioural model is that behaviour is perceived as primarily reinforced through the mind, after it has been learned socially. Thus, this model tends to downplay the fact that social interactions play a significant role in determining and shaping behaviour. Thus, although the cognitive-behavioural approach provides a strong basis for understanding the relationship between pathological behaviour and mood disorder, it underplays social contextual influences and so is best complemented by self-determination theory, which emphasizes the role the social environment plays in developing and shaping behaviour.

Hypotheses

In addition to determining the internal structural validity of the Problem Video Game Test index, this project 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 mood disorder 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 dismissing the negative feelings associated with mood disorders. Accordingly, I expect depression and anxiety to 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, I expect 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). I expect 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 I expect impulsiveness to 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, I expect 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, I expect that life satisfaction and mental health to 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, I expect 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, I expect those with higher levels of gaming motivation to 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, I expect 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, I expect that *individuals who score high on the Problem Gambling Severity Index will also score high on the PVGT.*

Chapter 3: Method

Data

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 and 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 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.

Measures: Dependent Variable

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. 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.

In order to assess the PVGT's suitability for exploratory factor analysis (EFA), Cronbach's alpha, Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) test for sampling adequacy values were obtained. Bartlett's test of sphericity was significant at the $p < .001$ (sig = .000) level. This suggests the correlations among variables used in this EFA do not form an *identity matrix,* and provides support for the suitability of these variables for factor analysis. Furthermore, the Cronbach's alpha (.951) and the KMO test score (.960) for the PVGT index also supported the PVGT's suitability for EFA.

After determining the PVGT's suitability for factor analysis, exploratory factor analysis was conducted in SPSS version 20. The results of the factor analysis will be discussed in the following section. The PVGT was then constructed by using the compute command in SPSS. The descriptive characteristics of the PVGT are summarized in Table 4.1.

Independent Variables

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).

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, Westerhof, Bohlmeijer, Klooster, & Keyes, 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, Emmons, Larson, & Griffin, 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.

Analytical Procedures and Missing Values Analysis

In order to maintain the maximum amount of responses, missing values analysis was conducted using SPSS version 20. This included independent samples t-tests for each variable, which tested group differences between the missing and non-missing groups, an analysis of the pattern of missing data, and Little's MCAR test. Upon assessing the data's suitability for imputation, multiple imputation was performed. The pooled imputation results are then compared to the un-imputed results to increase confidence in the findings.

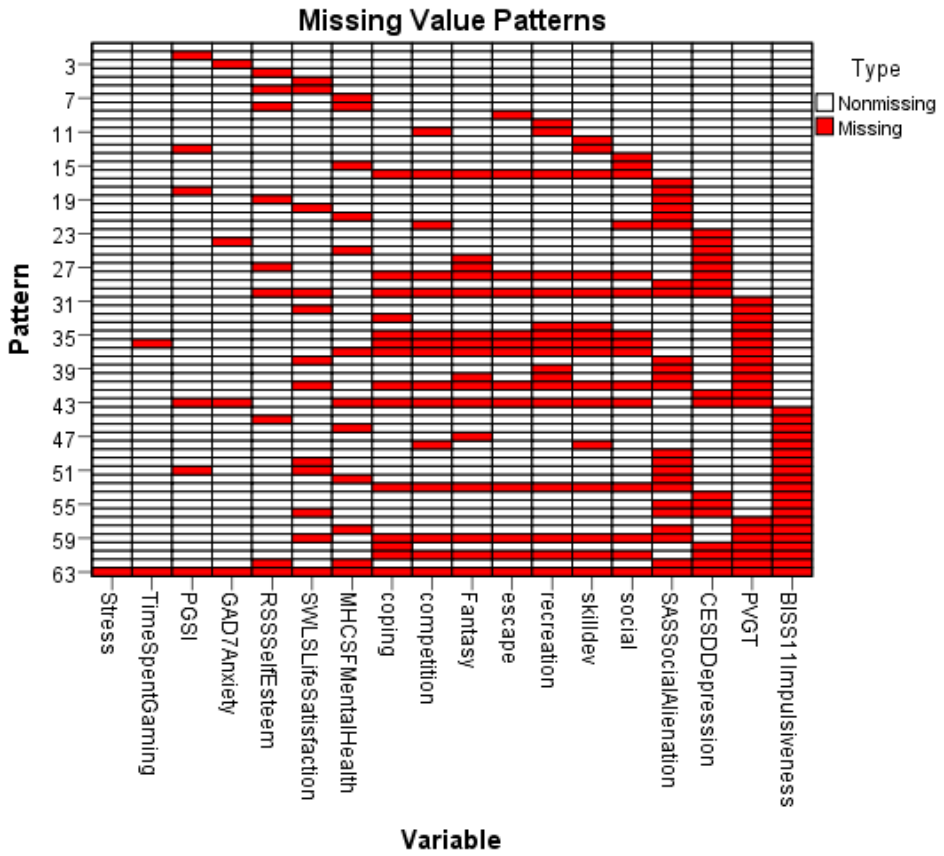
Analysis of the data indicated that no indices have missing values in the data greater than ten percent, while several had values above five percent, and therefore missing values needed to be addressed in this model. The measures of the PVGT, CES-D, BIS-11, the items in the MOGQ, and SAS all had between five and ten-percent of missing data. If pairwise deletion were applied, the result is the loss of almost one-third of individuals who reported playing video games for some period of time on an average week over the month prior to taking the SLWBS.

Dichotomous variables were created for the missing values for each variable, and were tested through independent samples t-tests using each dichotomous variable as a grouping variable. The dependent variable (PVGT) was used as a measure to determine whether there were significant differences between the missing and non-missing data. When the PVGT variable was analyzed, the GAD-7 variable was used to determine a significant difference, since it contained a relatively low number of missing scores. None of the t-tests were significant ($p<.001$), and therefore we can conclude that there were no significant differences between the missing and non-missing values for each variable.

The second step involved running Little's MCAR test in SPSS version 20. Each variable in which values were to be imputed were analyzed. Little's MCAR test (0.057, $p<.05$) was insignificant indicating that the data is missing completely at random.

One final check for suitability for imputation includes an analysis of missing values patterns. The missing values patterns table is presented in Table 3.1.

Table 3.1
Missing Values Patterns



As is evident from the missing values patterns table, some of the missing data is in isolated blocks, whereas others show slight overlap. According to the IBM SPSS Missing Values 20 guide, "[i]f the data are monotone, then all missing cells and non-missing cells in the chart will be contiguous; that is, there will be no "islands" of non-missing cells in the lower right portion of the chart and no "islands" of missing cells in the upper left portion of the chart. (IBM, 2011, p. 48). Therefore, we can conclude that the data in this model is not monotone, and imputation can be applied to "achieve monotonicity" (IBM, 2011, p. 48).

Multiple imputation was then performed in SPSS version 20. A total of twenty-five imputations were conducted, resulting in a total of six hundred ninety-two valid responses across each variable in the model. Pooled multiple regression estimates are reported in the results section.

PVGT validation. Several components of the SLWBS are useful for assessing the validity of the Problem Video Game Playing Test (PVGT). In addition to the PVGT, information was collected on individuals' gambling activities, sex, the length of time they spent playing video games, various motivators for online gaming, in addition to measures of depression, anxiety, stress, impulsiveness, social alienation, mental health, self-esteem, and overall life satisfaction. Together, these measures will be used to replicate and extend the construct validity test of the PVGT. The proposed analysis will use a subsample of SLWBS respondents who had reported playing video games for at least one minute during a typical week within the month prior to taking the survey, resulting in a study sample of 696 respondents.

To assess the validity of the PVGT, first an exploratory factor analysis will be performed on the items comprising the PVGT instrument. Second, in partial replication of King and colleagues (2011) preliminary validation study, bivariate correlations between measures for time, depression, anxiety, stress and the PVGT will be examined to assess the construct validity of the PVGT as it pertains to the present sample. Following this second step, OLS regression will be used to assess these relationships at the multivariate level. If the evidence supports the validity of the PVGT, then the final steps will involve examining additional theorized relationships between the selected psychological and social measures and the PVGT. These hypothesized relationships will be examined first via bivariate correlations and then via multiple regression. OLS regression is suitable for this study since the PVGT is a continuous variable, and satisfies the assumptions

for a general linear model. All continuous predictors are approximately normally distributed and VIF and Tolerance values indicate collinearity is not a problem.

Chapter 4: Results

Univariate Descriptives

Descriptive statistics for each of the independent variables used in this study are also reported in Table 4.1.

Table 4.1
Mean, standard deviation, and range of 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

Demographic characteristics. Of the six hundred ninety-six individuals who answered the video game portion of the Students' Leisure and Well-being survey, three hundred twenty-three (46.4 percent) were male, three hundred sixty-nine (53 percent) were female, and four (0.6 percent) did not state their sex. The average age of respondents who completed the survey in its pen and paper format was approximately 20 years, while the average age of respondents who submitted the survey digitally was approximately 25 years. Students who submitted the survey digitally had been enrolled in the distance education program, and this may explain the difference in age. The average age for all respondents was approximately 22 years at the time of taking the survey. Almost ninety (89.9) percent of respondents were enrolled in university courses full time, while over sixty (62.8) percent reported working part or full-time in addition to being a student. Respondents reported playing up to one hundred six hours (M=7.2, SD=10.4) of video games in a typical week in the month prior to taking the survey.

Exploratory factor analysis. The items used for this exploratory factor analysis (EFA) are all ordinal measures using a five point Likert scale design, and are represented in Table 4.2. Only one variable, which asked respondents how often they played online video games for longer than they had intended, had a median value of '1 = Rarely'. The remaining nineteen items in the index had a median value of '0 = Never', suggesting that among individuals who had played online video games for some length of time in the month prior to taking the survey, most did not experience the associated feelings in relation to their online video game playing. Thus, feelings of negative associations with online video game playing were not common amongst individuals who reported playing video games at the time of taking the survey.

Table 4.2
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

This is further emphasized through looking at the mean and standard deviation for these items. In most cases, the mean values for each of these items is similar to the median score. In fact, only the mean response for the question asking whether respondents played video games in order to alter their mood had a mean score one point higher than its median score (a score of rarely instead of never). This suggests that playing online video games to alter one's mood occurs more frequently or intensely than other factors related to problematic video game playing. The standard deviation for each item ranges from 0.75 to 1.27, and suggests that for most items, the majority of responses were close to the median and mean scores, with most users scoring between 'never' and 'sometimes' on each measure.

An analysis of measures of central tendency on these items reveals that for each item in question, responses clustered around the 'never' response. While the mean and standard deviation suggest a slightly larger spread of the data from respondents, none of these measures suggesting respondents had a high frequency of these feelings associated with problematic online video gaming within the month prior to taking the survey.

Verifying EFA assumptions. The first assumption for performing an exploratory factor analysis relates to sample size. According to Tabachnik and Fidell (2013) correlation coefficients require a large sample size to be considered reliable. In the case of low communalities (squared multiple correlations between variables) and weak factor loadings, Tabachnik and Fidell recommend a sample size of over five-hundred cases is necessary for Factor analysis. The sample size assumption is satisfied for the data currently under analysis, where the sample size exceeds six hundred fifty cases for each variable.

The second assumption is that factor analysis requires a continuous level of measurement for the variables under analysis. While the variables under consideration in this analysis are

ordinal, they use a five-point Likert scale and so they act like a continuous variable. Jamieson (2004) suggests that the five-point Likert scale is commonly used and treated as a continuous variable, although some researchers disagree with this application. Lubke and Muthén (2004) suggests that a five-point scale is acceptable with a sufficient sample size, whereas Grace-Martin (2015) suggests using a lower alpha level for any significance tests when treating ordinal variables as continuous, and so this will be kept in mind for this analysis.

The third assumption is that variables are normally distributed. Tabachnik and Fidell (2013) state that while this assumption is not paramount, normally distributed variables enhance the results of factor analysis. However, multivariate normality is assumed when determining the number of factors through a factor analysis. Tabachnik and Fidell suggest using measures of skewness and kurtosis as a means of assessing normality for single variables, and these values are depicted for each variable in Table 4.3. In order to address skewness and kurtosis, Tabachnik and Fidell suggest using structural equation modelling methods to transform variables that are heavily skewed. Several variables in this analysis are positively skewed, since many respondents reported low frequencies of each variable. Because structural equation modeling is beyond the scope of this factor analysis, this will remain a limitation to the interpretation of the results of this analysis.

Table 4.3
Skewness and kurtosis values

Variable	Skewness	Kurtosis
Play online games over going out with others	1.253	0.693
Outburst/annoyed when someone interrupts online game session	1.295	1.039
Fear life without online games would be boring/empty/joyless	1.871	3.031
Feel preoccupied with online games when not playing	1.785	2.780
Block unwanted thoughts about your life with thoughts about online games	1.570	1.630
Neglect household chores to spend more time playing online games	1.011	0.226
Lose sleep due to late night online gaming	1.112	0.421

Feel depressed/moody/nervous when not playing games which goes away when you go back to playing online games	2.569	6.697
Often play online games for longer than intended	0.430	-0.885
Try to hide how long you play online games	1.862	2.897
Work suffers due to amount of time spent playing online games	1.412	1.214
Job performance suffers due to online games	2.524	6.719
Become defensive/secretive when asked about how much you play online games	2.471	6.128
Anticipate when you can play online games again	1.326	0.993
Play online games before something else that needs to be done	1.104	0.477
Try to cut down on time spent playing online games but fail	1.648	2.073
Do others in your life complain about your online game playing	2.165	4.380
Find yourself setting and ignoring reminders to stop	1.139	0.357
Avoid spending time with partner/non-game playing friends to play online games	2.607	6.921
Play online games as a means of changing your mood (relax tension or for excitement)	0.855	-0.530

One final assumption is that there is a linear relationship between the variables being analyzed (Tabachnik & Fidell, 2013). Because the Likert scale used is an ordinal measure that acts continuously, testing for linearity through a scatterplot yields a difficult interpretation. This also constitutes a limitation to this analysis.

Factor Analysis

Factor extraction was performed using principal components analysis in SPSS 20. Table 4.4 presents a summary of the factor loadings from the principal components extraction, and weak factor loadings (below 0.3) are omitted from the table. Dominant factor loadings are in bold font.

Table 4.4
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	

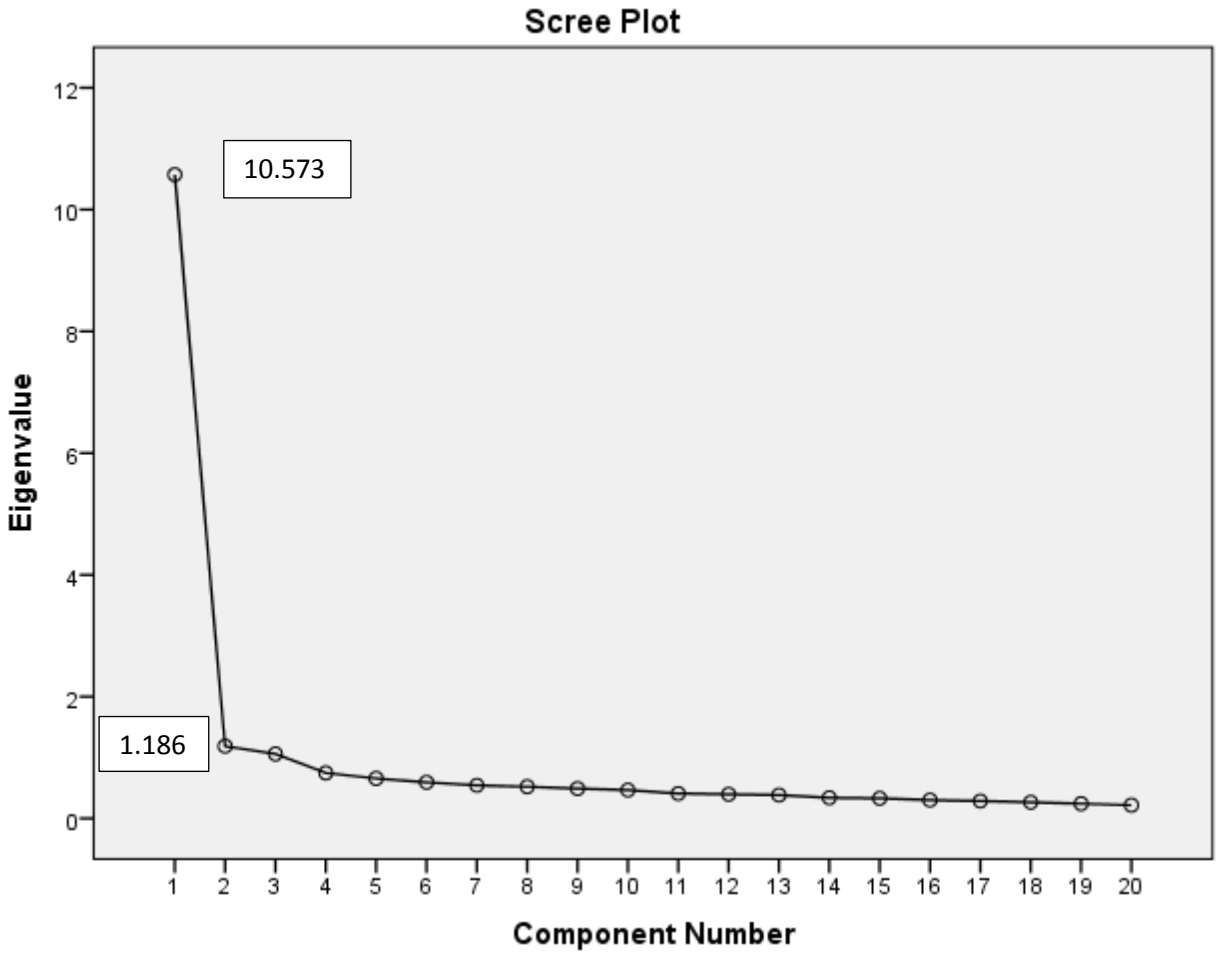
Block unwanted thoughts about your life with thoughts about online games	**0.750**	0.365	
Neglect household chores to spend more time playing online games	**0.756**		
Lose sleep due to late night online gaming	**0.746**		-0.320
Feel depressed/moody/nervous when not playing games which goes away when 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**		

While the principal components analysis extraction method yields loadings on three factors, we can see that the strongest loading for each variable suggests a single factor solution. Importantly, variables that had weaker loadings on separate factors appear to match each other in terms of face value; the variable that measured defensiveness as a result of being asked about their gaming paired well with the variable measuring the respondent's hiding of gaming activities, and the variables that measured preoccupation with gaming loaded well together. Regardless, a single factor solution is proposed through the analysis of factor loadings, and is reinforced through an analysis of the variance explained by these variables.

When looking at the variance explained by each component in the principal components analysis extraction method, we see that a single factor solution explains over fifty-percent of the variance in the variables forming the PVGT. Furthermore, the eigenvalue on the first component

is very high (10.573), whereas the eigenvalues for components two and three were slightly higher than one (1.186 and 1.059 respectively), and therefore justification for a three-factor solution based on eigenvalues is possible, but weak (Pett, Lackey, & Sullivan, 2003). Additionally, inspection of the scree plot, shown in Figure 1, shows a sharp inflection point that supports a single factor solution. Taken together, the evidence suggests that the PVGT is best explained by a single factor solution in this sample.

Figure 4.1
PVGT Factor Scree Plot



Validation Hypotheses

Bivariate analyses. Pearson correlations were obtained between each independent variable and the PVGT. The Pearson correlation coefficients for items used in the convergent validity analysis are presented in Table 4.5, while items with hypothesized relationships to problem video gaming are included in Table 4.6.

Table 4.5
Predictors of PVGT (original convergent validity measures)

Independent Variable	Pearson's r
GAD-7	0.164**
CES-D	0.247**
LESS	0.77
Time	0.448**

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

Table 4.6
Additional predictors of PVGT

Independent Variable	Pearson's r
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

At the bivariate level, there is evidence to support hypotheses one and three. Depression and anxiety, as measured by the CES-D and GAD-7 respectively, are both positively correlated with the PVGT and are significant ($p < .01$), suggesting that higher scores on these measures are related to higher scores on the PVGT. Correlations between the CES-D, GAD-7 and PVGT are modest, with values similar to those found in the PVGT's preliminary validation study (King et al., 2011). Furthermore, the length of time an individual spent playing video games in an average week was positively associated with scores on the PVGT, and the relationship is significant ($p < .01$). A Pearson's r coefficient of 0.448 suggests a near-moderate-strength positive association with the PVGT. Thus, there is evidence to suggest that larger amounts of time invested in playing video games is associated with higher scores on the PVGT. Together, these correlations provide evidence that the PVGT has convergent validity.

The LESS was not significantly related to PVGT scores at the bivariate level. One possibility for this finding relates to the fact that the stress, as measured by the LESS, is markedly different from the DASS stress measure. Indeed, the LESS only measures those individuals who report experiencing particular life events, whereas the DASS stress index measures items such as inability relaxing due to stress, nervousness and agitation among others (Lovibond & Lovibond, 1995). This study is therefore unable to ascertain whether stress is significantly related to the PVGT in this sample.

Multivariate analyses. The pooled results from both multiple regression models used in this analysis are reported in Table 4.7. Standardized beta values are reported for each variable in the models. Items used in these models appear to be approximately normally distributed, while only two measures (*Social* motivation, PGSI) have skewness and/or kurtosis levels beyond 2.0. 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=0.723). Therefore, this model does not appear to contain redundant measures. Importantly, VIF scores did not exceed 5 for any item in these models, with most VIF scores falling in around 2. Tolerance scores did not fall below 0.2, with most scores being around 0.4. This provides evidence that there is not a multicollinearity problem, as there were not VIF scores above 5 or tolerance scores below 0.2 (O'brien, 2007). In comparing these imputed results with the original data (with listwise deletion of cases missing data), imputation resulted in a significant relationship between the items *competition* and *cope* and the PVGT (which were not significant with listwise deletion), and effect sizes were virtually identical for all items.

The first OLS regression model (Model 1) explored the relationship between items used in the original study assessing the convergent validity of the PVGT. While the CES-D positively predicts PVGT scores (beta=0.229, p<.001), the GAD-7 was not a significant predictor of PVGT scores in this model. Similarly, the LESS was not a significant predictor of PVGT scores in this model. *Time* was the strongest predictor of PVGT scores in this model (beta=0.407, p<.001). Thus, while the expected relationships between the measures for time and depression were evident in this model, anxiety and stress did not display their expected relationship with PVGT scores.

Although not unanimous, taken together, the EFA results as well as the bivariate and multivariate results, appear to give a generally strong indication that the PVGT is a valid and reliable measure of online problem gaming.

Additional Hypotheses

Bivariate analyses. Similar to the GAD-7 and CES-D, the measure for impulsiveness (BIS-11) was also positively related to the PVGT and is significant ($p < .01$), suggesting that

impulsivity is higher amongst individuals who score high on the PVGT. Additionally, social alienation, as measured by the SAS, is positively associated with the PVGT and is significant ($p < .01$). Thus, there is evidence to suggest, at the bivariate level, that depression, anxiety, impulsiveness, and social alienation predict higher levels of problem video game behaviour. These relationships are rather modest, however, as the Pearson's r coefficient for each is below 0.3.

The expected negative relationship between measures for self-esteem (RSS), mental health (MHC-SF), life satisfaction (SWLS) and the PVGT were significant at the bivariate level and significant ($p < .01$). This result provides evidence in favor of the hypotheses that lower scores on each of these measures are associated with higher PVGT scores. The correlation coefficients for each of these variables was modest, as none were greater than -0.3.

The variables that were most strongly associated with the PVGT included each item from the MOGQ. Moderate associations ($r > 0.5$, $p < .01$) were found between the motivations that measured recreation, skill development, competition, fantasy, social, and time spent gaming and the PVGT. Strong associations were found between the motivations for escape and coping ($r > 0.7$, $p < .01$) and the PVGT.

Table 4.7
Predictors of Problem Video Game Playing Test

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

Multivariate analyses. The second OLS regression model (Model 2) expanded upon the first model by including items that are theoretically related to problem gambling and problem video gaming.

Among mental health measures, only the Social Alienation Scale was significantly (beta=0.160, p<.001) associated with the PVGT at the multivariate level. This result suggests that while loneliness or social alienation has a unique influence on the development of problematic video game playing behaviour, disorders such as anxiety and depression do not appear to be a significant contributing factor to problem video game playing once other factors, such as video gaming motivations, are taken into account. Furthermore, life satisfaction and positive mental health did not have significant multivariate relationships to the PVGT.

While many mental health measures were not significant in this model, five of the gaming motivations taken from the Motivations for Online Gaming Questionnaire (MOGQ) were significantly related to the PVGT. The measures for the Escape (beta=0.292), Social (beta=0.207), and Recreation (beta=0.136) motivations were all significantly (p<.001) positively related to PVGT scores. The Competition (beta=0.107, p<.01) and the Cope (beta=0.115, p<.05) motives were also significant predictors of PVGT scores. Therefore, escape, recreation, social,

competition, and coping are motivational factors that are positively associated with a higher level of problematic video game playing. The motivational factors of skill development and fantasy were not significantly related to the PVGT in this model.

The amount of time an individual spent playing video games in an average week (beta=0.134, p<.001) was also significantly related to PVGT scores. That is, as time spent playing video games increases so do PVGT scores. Lastly, once other variables were controlled for, sex was no longer a significant predictor of problematic video gaming.

Results from the EFA indicate that the PVGT has a single factor structure with high average factor loadings. The items that form the PVGT display very good internal reliability. Checks for convergent validity using bivariate associations between GAD-7, CES-D, *Time*, and the PVGT yielded expected results, and therefore construct validity for the PVGT appears to be good; the PVGT appears to measure what it claims to measure—problem online video game playing.

Results from the multivariate models suggest that while items such as the GAD-7 and CES-D are significant at the bivariate level, when other factors are taken into account the impact of these variables is negligible. The expected relationships between anxiety, depression, stress, as well as the additional variables self-esteem, mental health, life satisfaction, sex, problem gambling and the PVGT were not evident when included in a regression model, in contrast, social alienation, time, and five of seven online gaming motivations (escape, recreation, social, competition, and cope) were significant predictors of online problem gaming.

Chapter 5: Discussion and Conclusion

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. In their original study, King and colleagues (2011) found that the PVGT displayed very high internal consistency (Cronbach's alpha = 0.93 and 0.92), and the PVGT performed similarly as well among SLWBS respondents (Cronbach's alpha = 0.951). Internal consistency was further confirmed through an analysis of correlations between individual items and the PVGT, where items were strongly correlated with total PVGT scores ($r>0.6$). This finding supports the results from the PVGT's preliminary validation study, where individual items were "moderately" correlated with the PVGT ($r>0.54$ and $r>0.48$ respectively) in the two studies conducted by King and colleagues (2011, p. 79). Furthermore, evidence from the exploratory factor analysis performed in the present study supports a single factor solution, and that the PVGT indeed measures the concept of problem online video gaming. King and colleagues (2011) came to a similar solution during their exploratory and confirmatory factor analysis of the PVGT in their study, and thus the PVGT appears to have a consistent application as an instrument that measures problematic online video gaming behaviour. Item loadings in this study are markedly similar to those found in the factor analyses performed by King and colleagues (2011), where factor loadings average a strength of 0.74. Correlations between individual items within the PVGT

To assist in the analysis of construct validity, there should be evidence of a relationship between known correlates of problem video gaming. King and colleagues (2011) suggest that the PVGT should target heavier video game users, and thus be correlated with the time one spends gaming. In this study, time spent gaming had a moderate, positive correlation with the PVGT

(r=0.448, 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". These findings, along with EFA evidence that supports the PVGT as a unidimensional measure of problem video gaming, help confirm the construct validity of the PVGT while providing some evidence for its convergent validity.

Another important check for the convergent validity of the PVGT involved the use of the Depression Anxiety Stress Scales (DASS) to explore the relationship between measures for depression, anxiety, and stress and the PVGT (King et al., 2011). The use of these "well-known correlates" provides an "alternative method" for assessing convergent validity in the absence of comparing test scores with "in-depth clinical assessment[s] conducted by a psychologist" (King et al., 2011, p. 81). Thus, while the measures used for depression, anxiety and stress are different in this study from that of King and colleagues (2011), the results between these two studies share similarities. In the case of depression, the CES-D was weakly positively correlated with the PVGT (r=0.247, 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=0.164, 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 significant relationship between anxiety and problem video gaming. A comparable measure for DASS stress was not included in the SLWBS,

and while stress was assessed in this study using a modified version of the LESS, it was found to be insignificant in its relationship to PVGT scores at both bivariate and multivariate levels. This alone should not dissuade the use of the PVGT, as the LESS focuses upon measuring the presence of stressors and individuals' associated perceptions of stress (Linden, 1984), while the DASS stress index includes other items, such as irritability and agitation, that relate to stress (Lovibond & Lovibond, 1995). However, the pattern of associations evident in this bivariate analysis of expected correlates with problem video gaming support a similar interpretation to that of King and colleagues (2011, p. 84), in that it appears that problem video gamers "may be at a low risk of anxiety or depression". Thus, the PVGT appears to be a valid measure based upon the EFA and the existence of the expected bivariate relationships between play time, anxiety, depression, and the PVGT.

While King and colleagues (2011, p. 84) found evidence that "psychological distress" measures, including anxiety, depression, and stress were significantly, but weakly, related to the PVGT, this study did not find such a relationship at the multivariate level. Indeed, items used to measure anxiety and depression, the GAD-7 and CES-D, where significantly related to the PVGT at the bivariate level. This suggested that anxiety and depression scores were symptomatic of problematic video game playing. A multivariate analysis including the GAD-7, CES-D and our time measure revealed that the GAD-7 was not a significant predictor of PVGT scores. Furthermore, the significance of the CES-D disappeared when other factors including social alienation and gaming motivations were controlled for. King and colleagues (2011, p. 84) had suggested that these mental health measures may have been underreported in their study due to the high portion of male respondents who may not have felt comfortable "reporting any emotional difficulties". However, due to the almost equal distribution of males and females

within the SLWBS, it may be that any such gender difference was not in effect in the present study.

This project also included the BIS-11 as a means of measuring the concept of impulsiveness as it relates to problem video game playing. As with other mood disorder measures, impulsiveness was weakly positively bivariately correlated with the PVGT ($r=0.168$, $p<.01$), but at the multivariate level, impulsiveness was no longer a significant predictor of problem video gaming, suggesting that the majority of video gamers do not exhibit a high degree of impulsivity.

While problem gambling is often associated with a high prevalence of mood disorders (Martin, 2008; Black & Moyer, 1998; Becona, Lorenzo, & Fuentes, 1996), and there exists reasoning to suggest a similar connection between mood disorders and problem video gaming (Delfabbro & King, 2015), the results of the present study suggest that mood disorders are weak predictors of problem video gaming at the bivariate level, and insignificant at the multivariate level. Thus, while problem gambling is often discussed as having a comorbid relationship with disorders such as depression and anxiety, this study suggests that comorbidity only tenuously applies to problem video gaming.

The results from this examination of mood disorders and their relationship with problem video gaming provides evidence for an explanation provided by King and colleagues (2011), that there may exist subclasses of gamers that are not readily apparent from the data. This utilizes research by Blaszczynski and Nower (2002) that categorizes problem gamblers based upon their differing scores on measures for psychopathy or mental health. In the case of gamblers, Blaszczynski and Nower (2002) suggest the need to differentiate problem gamblers from gamblers with problems, and such a case may exist for problem video gamers. Furthermore,

King, and colleagues (2013) suggest that characteristics related to problem video game play, including time investment, vary based upon the type of video game they play. For example, individuals who play MMO-style games play more frequently and for greater lengths of time compared to gamers who interact with other game designs. Thus, and due to the low expected prevalence rate of problem video gaming, the PVGT may contain groups of people who excessively play games but do not exhibit disordered play, as suggested by the lack of a strong relationship between depression, anxiety, impulsivity, and the PVGT. Problem gamers may differ not only in the types and genres of games they play, but may differ in their relationship between mood disorder and video gaming habits. Future research could utilize Latent Class Analysis to determine whether different classes of gamers exist based upon video game medium and genre preference, in addition to disordered and 'normal' play.

Furthermore, it was expected that other mental health measures—well-being, self-esteem, life satisfaction—would be negatively associated with PVGT scores, suggesting that lower mental health is a condition associated with problematic video game play. At the bivariate level there is evidence to suggest that this is the case. Correlations between the measures for self-esteem ($r=-0.208$, $p<.01$), mental well-being ($r=-0.226$, $p<.01$), and life satisfaction ($r=-0.225$), $p<.01$) were significantly, although modestly, negatively associated with the PVGT. These bivariate relationships provide evidence for an understanding that excessive video game use occurs as the result of escape or displacement, where individuals play video games as a means of increasing their short-term well-being, even if it does not persist in the long-run (Przybylski et al., 2010; King et al., 2013). However, and perhaps due to the weak negative association between these measures and the PVGT, the relationship between these mental health measures and the PVGT vanishes when other factors, including social alienation, are accounted for in a

multivariate model. Perhaps the most convincing explanation for this finding is that, as with mood disorders, there are significant portions of gamers who excessively play video games in the absence of low mental health, and that gamers with lower mental health form a subtype of the problem video gamer population. Thus, future research could explore this potential group of gamers to determine whether distinct characteristics relate to their problematic video game playing. Latent class analysis could explore whether certain types of gamers are more or less likely to have mental health concerns, or whether certain types of gaming-related activities attracts individuals with particular mental health or mood disorders.

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). The significant relationship between social alienation and problem online video gaming suggests that a lack of connectedness to the social world is characteristic of problematic video game playing. Self-determination theory would suggest that individuals in this study display higher problem online gaming behaviour as a result of a motivation to play to satisfy a need for *relatedness.*

It is worth mentioning the difficulties that arise from our attempts to measure social alienation in an increasingly digitally connected world. The SAS was initially developed with the goal of measuring the concepts meaninglessness and social isolation, which form the concept of social alienation (Jessor & Jessor, 1977). Safipour and colleagues (2010) suggest that alienation

measures how motivated an individual is to conform to the norms of a society, and a lack of convergence between individuals' motivations and societal norms/expectations can be a cause for conflict. Similarly, self-determination theory relates a person's motivation to conform to societal norms with the satisfaction of human needs (Deci & Ryan, 2011). In this case, self-determination theory would suggest that while social alienation or isolation may be occurring among individuals who score high on the PVGT, those individuals may be satisfying their need for social connectedness through their online playing. Importantly, the SAS focuses heavily on offline social connections and does not explicitly address relationships that may occur in an online world. In this way, the SAS reflects the bias that offline relationships are characterized by greater connectedness than digitally formed ones (Domahidi et al., 2014). Thus, perhaps the SAS does not accurately reflect what it means to be socially isolated or alienated in an increasingly digitally connected world.

In fact, this is supported by the finding that the social motivation for playing online video games was the second strongest predictor of excessive game play in the multivariate model. First, at the bivariate level the social motivation for online video game playing had a significant and strong positive association with the PVGT ($r = 0.658$, $p<.01$), suggesting that heavier video game play occurs through a desire for social connectedness. With other factors taken into account through OLS regression, the social motivation for play remains significant in its relationship to the PVGT. Self-determination theory helps explains this finding, that if an individual is feeling socially isolated in the offline world, they can satisfy this affiliative need by pursuing social connections digitally through social video game play. Importantly, the depth of the social connections formed through these digital interactions is worthy of attention, as there is disagreement regarding the depth of digitally formed social connections (Ducheneaut et al.,

2006). Regardless, individuals who display a higher degree of problematic online video game playing (as indicted by their PVGT score) also report a desire for social connectedness as a strong motivational factor driving their play.

While mental health measures were not significant predictors of PVGT in the regression model, the motivational factors of escape ($r=0.712$, $p<.01$) and coping ($r=0.715$, $p<.05$) 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 mood disorder or mental health (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 mood disorders and problem video gaming. Although mental health and mood disorder items 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 and mood disorders.

The fantasy dimension of gamer motivation had a strong positive bivariate association with the PVGT, suggesting that excessive video game play results from a desire to relocate and immerse oneself in a digital world. However, the fantasy dimension was not a significant predictor of problem play when other factors were controlled for, and therefore this motivational factor does not appear to predict problematic video game playing.

The motivational factors for play, which relate to self-determination theory's concept of competence, include competition and skill development. Although playing games as a way of enhancing one's own skills was positively correlated with PVGT scores at the bivariate level, it was insignificant at the multivariate level. The factor measuring competitiveness, however, was positively associated with the PVGT at the bivariate level ($r=0.591$, $p<.01$) and remained a significant predictor of PVGT at the multivariate level ($p<.01$). Thus, competition, but not skill development, as a way to feel competence in one's own abilities appears to contribute to problematic video game play. Video games provide many avenues to compete socially (for in-game status and in-game rewards) and/or individually (complete tasks or challenges). This relates to the problem gamblers who are characterized by a competitive motivation, those who seek to impress others with their gambling prowess by chasing success in highly skill-based gambling forms (Blaszczynski & Nower, 2002). By successfully completing tasks, and obtaining the means to inform others of your skill (through in game leaderboards or special items), video gamers satisfy their need for competence, less through skill development itself, but rather by displaying their ability to themselves (or others) through success in competitive video game play.

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 mood disorders 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.

There is evidence to suggest that males are more likely than females to be problem video gamers. The *sex* variable used in this study was modestly negatively correlated with PVGT scores ($r=-0.310$, $p<.01$), providing evidence for a link between male sex and higher problem video gaming. This relationship disappears in the OLS regression model, however, suggesting

that sex differences are not a strong predictor for problematic video gaming when other factors are taken into account.

Finally, the amount of time an individual spends playing in a typical week displayed the expected relationship with problem video gaming. *Time* was a significant predictor of PVGT scores at both the bivariate and multivariate levels, although it appears to be a weaker predictor for PVGT than other factors, such as the *escape* and *social* motivations and social alienation. It is clear, however, that excessive video game playing is predicated on time spent playing.

Limitations and future directions

One limitation of this study relates to the diverse nature of video game players. First, 63.4% of scores on the PVGT from the SLWBS fall into the category Young (1998) called "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). Similar to King and colleagues (2011) discussion of 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. As mentioned in this study, and as King and colleagues (2011) suggest, there is potential for the existence of distinct subgroups of video gamers with unique characteristics and gaming motivations. An analysis of this kind could provide insight

into how problematic gaming behaviour may be experienced differently based upon the characteristics of each gamer sub-type.

Similarly, such an exploration into the types of video games gamers play could reveal valuable insight into problematic video gaming. It is possible that certain genres of game, and varying game designs, may attract a specific 'type' of gamer with greater disposition towards problematic levels of play and that different genres or designs may contribute to higher prevalence of problematic play. Video gamers in this study were not differentiated based upon the medium of play, genre of play, or game design. For examples, games with a MMO design, such as *World of Warcraft*, are commonly discussed as containing elements which may contribute to excessive and/or problematic play (King et al., 2013). Future research could explore the relationship between these factors and problematic video game playing.

While the links between mood disorders and health measures were apparent at the bivariate level in this study, these connections vanished in the OLS regression model. Thus, it is unclear as to whether these factors have a predictive capacity for problematic video game playing. Future research could explore whether the link between these factors and problematic video game play exists only for some sub-groups of gamers, and whether other motivational factors supersede the impact of mental well-being and mood disorder.

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 met with extreme caution, 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.

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

Analysis of PVGT items provides 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. 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. Thus, the evidence suggests the PVGT is a valid measure for problem video gaming in this sample of university undergraduate students.

While anxiety and depression were correlated with the PVGT, this relationship did not hold at the multivariate level. When factors such as depression and time were controlled for in the regression model, anxiety was not a significant predictor of PVGT scores. Furthermore, the inclusion of other hypothesized predictors in the regression model resulted in depression being an insignificant predictor of PVGT scores.

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. 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. 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.

This research project was limited by its sample which was cross-sectional and did not focus primarily on video gamers. While this project 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. Furthermore, the understanding of problem video game play would benefit from longitudinal analysis, where behaviours and responses, among mental health and mood disorder measures, can be tracked an analyzed over a period of time. This research could provide significant insight into the topic problem video gaming by providing in-depth analyses of the relationship between mental health and problematic play.

Finally, the findings of this project 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 contain high prevalence rates of mood disorder 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. While this research project did not establish a link between factors that place an individual at higher risk for problem gambling and problem online video gaming, it is important that the nature of the connection between these factors and problem online gaming. If problem gaming, or video gaming in general, provides a pathway to problem gambling, it is necessary to have safeguards in place to prevent a young generation of gamers from developing gambling problems in the future. A greater understanding of the connection between problem online video gaming and problem gambling, and their associated risk factors, can help mitigate the potential for personal and social harm that arises from these disorders.

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