2016

Applying the Transtheoretical Model to Problematic Digital Game Use

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APPLYING THE TRANSTHEORETICAL MODEL TO PROBLEMATIC DIGITAL GAME USE

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

PSYCHOLOGY

UNIVERSITY OF RHODE ISLAND
2016

DOCTOR OF PHILOSOPHY DISSERTATION

OF

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2016

ABSTRACT

The Transtheoretical Model (TTM) of Behavior Change has been applied to a plethora of different behaviors in an effort to allow individuals to reduce problem behaviors or increase healthy behaviors. One behavior that has not yet been applied to the TTM is problematic use of digital gaming. Although digital gaming is not necessarily a problem behavior, it can lead to problematic effects in a certain percentage of users. The purpose of this dissertation is to begin developing TTM measures to examine problematic digital game use and the impacts it can have on an individual's life. A Decisional Balance and a Self-Efficacy measure were developed, and a number of additional statistical analyses were conducted to examine digital game users who spend at least 20 hours a week playing digital games, a population likely at risk of experiencing at least some problematic impacts in their lives from digital game use. The findings indicate that the measures show promise in applying the TTM to digital gaming, an area constantly growing in importance. Further, higher amounts of time spent playing digital games may lead to more problematic use and symptoms, such as increased impulsivity and anxiety, and decreased overall wellness

ACKNOWLEDGEMENTS

I would like to thank my major professor Dr. James Prochaska. Dr. Prochaska has been a significant help throughout the completion of my dissertation, and has provided exceptional guidance over the years I have been fortunate enough to work with him. His mentorship and guidance throughout my time at URI has meant a tremendous amount to me. Additionally, I would like to thank my core committee members, Dr. Andrea Paiva, and Dr. Bryan Blissmer, for their support throughout the completion of both my dissertation and my comprehensive exams. Last but not least, appreciation is owed to the additional members of my defense committee, Dr. Mahler and Dr. Flannery-Schroeder, who both also provided excellent feedback during my comprehensive exams. It's been a pleasure working with all of you.

DEDICATION

This dissertation is dedicated to all of my family, but especially my parents and siblings. All of you have provided unconditional love and unfailing support to me over the years, and words cannot properly describe my gratitude to all of you. I hope I can continue to repay all of you now that my most time consuming projects have been completed.

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CHAPTER 1

INTRODUCTION

Video game use has increased steadily in Western society and now rivals television and movies as a form of recreation (Spence & Feng, 2010). However, the term "video games" is already outdated, as many types of games are played on computers, cell phones, and other electronic sources. A digital game is a more all encompassing term, defined as any type of game played on a video game console, a computer, a smart/cell phone, or in any other electronic form. As digital games continue to become more popular, society has become dubious about this relatively unknown entity, and as a result many questions have arisen about the games. Perhaps the most frequent of these questions is whether these games have positive or negative effects on the people that play them (Skoric, Ching, & Neo, 2009). This dissertation will investigate some of the effects digital games may have on a sample of adults who play or previously played at least 20 hours a week. This number was chosen because it seemed a good starting point to examine users who are either currently or have previously been at risk of becoming a problematic user, or a digital game user who experiences many negative impacts in their life as a result of their gaming. Measures will be used to assess the frequency and prevalence of problematic game use, as well as assess whether a digital game user is likely to become a problematic game user in the future. Last, problematic game use will be explored via the Transtheoretical Model (TTM) of behavior change to determine whether it can be used as an effective theory to assist in examining problematic use, as research indicates that the TTM has been

effective in helping individuals change many types of problematic behaviors (Hall & Rossi, 2008).

CHAPTER 2

REVIEW OF LITERATURE

Video games alone are frequently played by players of all ages. Current estimates state that 40% of adults regularly play video games, and 86% of adolescents play them regularly (Williams, Yee, & Caplan, 2008). According to the Entertainment Software Association (2010), 72% of the general population reported playing video games, while 97% of teenagers ages 12-17 reported playing video games. These estimates are not accounting for other types of digital games, which are probably played even more frequently than video games.

A good deal of research focuses on the potential negative effects of video games, looking at such problems as excessive or almost slavish game use (also called "addiction" or "problematic" use), aggression, loneliness, and so forth (Smyth, 2007; Meehroof & Griffiths, 2009; Thalemann, Wolfing, & Grusser, 2007). Estimates of these problematic users vary quite a bit, especially since criteria used to define problematic use frequently varies. For instance, a study by Grusser, Thalemann, & Griffiths (2007), which included 7069 gamers, found 11.9% of participants exhibiting gaming behavior that fulfilled diagnostic criteria for addiction. On the other hand, Lemmens, Valkernberg, & Peter's (2009) defined the problematic use slightly differently, and they found that 2.3% to 9.3% of their sample of around 700 video game players engaged in pathological use. The difference was due to whether addicted use was defined by meeting all of the seven addictive video game criteria the researchers developed (2.3%) or four out of the seven criteria (9.3%).

It is not clear cut whether digital games actually create problematic symptoms. Though few researchers have argued that excessive use is not capable of some potential negative impacts, numerous researchers have provided evidence that digital games may not increase aggression (Ferguson, 2010; Markey & Markey, 2010; Unsworth, Devilly, & Ward, 2007). Other studies and articles explore some of the potential positive effects that may result from digital games, such as their utility as teaching tools, to develop certain cognitive abilities, to develop prosocial behaviors, and to increase the benefits of therapy (Greene & Bavalier, 2007; Clarke & Schoech, 1984; Ceranoglu, 2010; Spence & Feng, 2010; Kato, 2010; Saleem, Anderson, & Gentile, 2012).

An additional important question is whether the type of digital game can impact its positive/negative effects. Since digital games significantly vary in their content, certain studies (Smyth, 2007; Rehbein et al, 2010) have indicated that certain types of digital games, such as *Massively Multiplayer Online Role-Playing Games* (MMORPP's) could have stronger negative impacts than other types of games. While some studies have explored the varying effects of different types of games, particularly within violent games (Anderson & Dill, 2000; Bers, 2010; Green & Bavalier, 2007; Saleem, Anderson, & Gentile, 2012), it is an important consideration in treatment.

Based on previous studies, there is reason to believe that the impact from digital games, both positive and negative, vary from person to person, especially when it comes to potentially increasing aggression (Markey & Markey, 2010). If impact varies widely across individuals, it is critical to evaluate what these positive or

negative impacts might be. Without doing so, it would be difficult to weigh the Pros and Cons of a person's digital game use and, if necessary, provide an effective intervention to develop a more balanced amount of use.

Efforts have been made to create assessment tools to measure the effects of video games, though the authors have not mentioned if these tools are applicable to all types of digital games. Currently, there are many recognized tools that measure these effects. Some examples of these tools are The Game Addiction Scale for Adolescents (Lemmens, Valkenberg, & Peter, 2009), The Problem Video Game Playing Test (King, Delfabbro, & Zajac, 2009), The Problem Video Game Playing (Salguero & Moran, 2002), The Game Engagement Questionnaire (Brockmyer, Fox, Curtiss, McBroom, Burkhart, & Pidruzny, 2009), and the Pathological Gaming Scale (Gentile, 2009). Since "video game addiction" is a very strong term, the majority of researchers prefer using the terms "pathological video game use" (which is typically based off of pathological gambling criteria) or "problematic video game use." Regardless of the title, virtually all of these criteria (with the exception of the Game Engagement Questionnaire) are developed from DSM criteria (American Psychiatric Association, 2000), while the Game Engagement Scale is designed to measure how much flow a gamer is experiencing in an attempt to measure their level of engagement during gameplay (Brockmyer et al.,, 2009). Since the release of the DSM-V (American Psychiatric Association, 2013), most researchers have started evaluating the impact of digital gaming based on the criteria of "Internet Gaming Disorder," which is also derived from criteria very similar to the DSM-V's "Gambling Disorder" criteria (American Psychiatric Association, 2013).

In terms of internal reliability, the assessment tools that measure problematic video game use appear to be well constructed, which is indicated in the various studies in which the tools are tested (Lemmens, Valkenberg, & Jochen, 2009; King, Delfabbro, & Zajac, 2009; Salguero & Moran, 2002). However, one issue is that the questionnaires do not appear to account for other types of digital games, though it is unclear whether participants may have included other types of digital games when reporting their use and their problematic symptoms.

In terms of defining problematic or pathological game use, it is simply not clear how to define truly problematic use. With the exception of Brockmyer et al. (2009), who evaluated video game engagement as indicative of problem use, the tools simply assume that problematic gaming use is similar to Gambling Disorder or substance abuse. For example, King (2009) used criteria similar to Young's Internet Addiction Test (1998), where a score of 40 or higher indicated problem use. Young's Internet Addiction Test (Young, 2013) was also based off criteria from pathological gambling in the DSM (American Psychiatric Association, 2000). Strangely, the cutoff score of 40 appears different than the ones found on Dr. Young's current website, where the cutoff is instead set at 50 (Young, 2013). More recently, the DSM-V (American Psychiatric Association, 2013) has proposed "Internet Gaming Disorder" as meeting "five or more problematic criteria over a 12-month period." As previously stated, the 10 different criteria for Internet Gaming Disorder in the DSM-V are mostly similar to pathological gambling and other types of addictions. However, it remains unknown if these are truly the best criteria go apply to a new potential area of addiction.

Although most of the definitions of problematic gaming are relatively similar, it remains possible that problematic gaming is simply a result of co-morbid symptoms, such as depression, anxiety, social phobia, ADHD, etc. In other words, depressed individuals may simply be more likely to play digital games, and would have engaged excessively in another other type of behavior (like television or reading) if digital gaming had not been available to them. However, some research indicates that digital gaming may be a problematic behavior that is more than a result of psychiatric comorbidity. According to a longitudinal study by Gentile et al (2011), children who became problematic game users over a two year period showed statistically significant increases in depression, anxiety, and social phobia. Additionally, children who started as problematic users but stopped their problematic use over the two year period showed statistically significant decreases in depression, anxiety, and social phobia. These results indicate that problematic digital game use could be more than a resulting consequence of depression, anxiety, or social phobia. As such, it becomes very important to determine what factors might be the best predictors of future problematic game use to prevent these serious problems from developing. Fortunately, numerous studies have identified some predictors of being at risk for becoming a problematic user (Rehbein et al, 2010; Gentile et al, 2011; Lemmens, Valkenberg, & Peter, 2011; Rehbein & Baier, 2013; Haagsma et al, 2013).

Although previous questionnaires have focused on identifying problematic video game users, it is also important to begin determining treatment steps for these users. It would also be a mistake to neglect other forms of digital game users, hence why using the term "digital gaming" would allow for all types of digital gaming

impacts to be properly studied. A potential behavior change theory that could assist in developing a treatment approach is the Transtheoretical Model, or TTM (Prochaska & Velicer, 1997). The TTM is a widely used model of behavior change that has been used effectively to change a wide variety of problem behaviors (Hall & Rossi, 2008). The model has four constructs, including Stage of Change, Decisional Balance (Pros and Cons), Processes of Change, and Self-Efficacy. Stage of Change refers to a person's readiness to change their behavior. The stages in the Stage of Change are Precontemplation (the user is not ready to change their behavior in the next 6 months), Contemplation (the user is ready to change their behavior in the next 6 months), Preparation (the user is ready to change their behavior in the next 30 days), Action (the user has been effectively changing their behavior for less than 6 months), and Maintenance (the user has been effectively changing their behavior for more than 6 months). Decisional Balance varies by stage of change based on whether a person perceives higher levels of Pros than Cons in their problem behavior (Prochaska & Velicer, 1997). Last, Self-Efficacy is defined as a person's belief in their abilities to execute the courses of action required to change (Bandura, 1997). Assessing the Pros and Cons of change, Self-Efficacy, and Stage of Change will be essential, as they all prove to be very good predictors of behavior change (Velicer, Brick, Fava, & Prochaska, 2013). Since the TTM has been used to develop computer tailored interventions to effectively intervene for many different populations and for many different behaviors (Prochaska, DiClemente, Velicer, & Rossi, 1993; Velicer, Prochaska, & Redding, 2006; Hall & Rossi, 2008), the theory could prove valuable in developing computer tailored interventions to address problematic digital game use.

The goal of this dissertation was to assess problematic game users, game users who are particularly susceptible to becoming problematic users, and individuals who were previously problematic users, but learned to effectively moderate their use (i.e. users in Action or Maintenance). This was examined by having participants complete a questionnaire that assesses problematic game use, TTM measures, predictors of problematic game use, and well-being. The participant sample is the first of its kind to explore whether problematic and at risk users are ready or are willing to develop a healthy moderation of digital game use. It is also the first of its kind to evaluate the Stages of Change within the area of problematic digital game use. The dissertation is also unique in evaluating problematic gamer's beliefs about the potential positive impacts of their gaming. In other words, despite the problems they are experiencing, these gamers might also believe they are experiencing benefits from their gaming use. Whether these perceived benefits are accurate or inaccurate, they are clearly important to evaluate in determining the ideal amount of use an individual can spend that will maximize the potential benefits and minimize the potential detriments.

CHAPTER 3

METHODOLOGY

Participants

Participants were recruited via various online gaming forums and gaming Facebook groups. In total, 319 adults over age 18 agreed to participate. Each of the 319 participants either engage in 20+ hours per week of digital game use, or previously engaged in 20+ hours per week of digital game use. Participation in the study was equally open to all genders, races, ethnicities and differing sexual orientations. The full participant demographics are presented in Table 1.

Procedure

Human subjects and ethical concerns were addressed prior to data collection by seeking approval from the Institutional Review Board (IRB) during the fall of 2014. Each participant was asked to complete a survey that was developed using Survey Monkey, a secure and confidential online program where surveys can be created and completed. Although a brief description of the study was provided on the gaming forums and the Facebook groups, the full details were described to participants on the first page of the survey. This first page also contained a consent form, which participants agreed to before proceeding with the survey questions. Participants were informed that they would be completing the survey anonymously, that the survey had been tested to take approximately 15-20 minutes to complete. Additionally, participants were informed that if they wanted to list their e-mail, they would be entered into a raffle for the opportunity to win $250. The consent form also mentioned that if a participant chose to enter their e-mail, their e-mail would be kept confidential

and securely protected in a separate location from the rest of the survey data. They were also informed that the researchers would delete the e-mail addresses as soon as enough participants had completed the surveys and a raffle winner had been chosen and received $250.

Measures

Frequency of digital game use. A one question screen for problematic digital gaming was utilized. Participants were only included in the study if they currently spend at least 20 hours a week playing digital games, or previously spent at least 20 hours a week playing. Since digital game players may also spend a large amount of time watching digital games, researching digital games, or chatting in digital game forums, these activities were also included in the amount of time a person spends on digital games.

Demographic characteristics. A number of questions asked for age, gender, race/ethnicity, education level, amount of time spent working/in school, and country a participant grew up in. Demographic characteristics of the sample are presented in Table 1.

Marker behaviors of problematic or future problematic digital game use. These questions were used to determine current problematic use, as well as the risk for becoming a future problematic user. First, the 7 item Game Addiction Scale (Lemmens et al, 2009) was used. This tool has been used as a brief measure of problematic gaming and has been shown to have a Cronbach's alpha ranging between .81 to .86 (Lemmens et al, 2009). For this measure, a high score would indicate higher amounts of problematic consequences from gaming, while a low score would indicate

few (if any) problematic consequences from gaming. The raw scores were then converted into T-scores. Second, a few questions to assess risk of future problematic use were utilized**.** These questions consisted of a combination of previous measures found to be good predictors of future problematic use, as well as more specific questions also found to be good predictors. These questions included lack of control (Haagsma et al, 2013), type of game being played most frequently (Rehbein et al, 2010), and lack of success in other areas besides gaming (Rehbein et al, 2010). For these questions, participants reporting lack of control and lack of success in other areas besides gaming would be at higher risk of becoming more problematic users in the future, while participants reporting use of certain types of games (such as MMORPG's) would also be at higher risk of becoming problematic users. Third, impulsivity was measured using the 15 item Barratt Impulsiveness Scale. This scale has been found to be a good measure of impulsivity showing a Cronbach's alpha of .79, similar to that seen in the longer 30 item version (Spinella, 2007). Participants reporting higher raw scores would have high degrees of impulsivity, while low raw scorers would have good impulse control. Fourth, overall anxiety was screened using the 5 question Overall Anxiety Severity and Impairment Scale (OASIS), which has been shown to have a Cronbach's alpha of .80 and good one-month test-retest reliability ($k = 0.82$) (Campbell-Sills et al, 2009). Participants reporting high raw scores would likely have at least some type of anxiety difficulties, while low raw scorers would be unlikely to have any difficulties with anxiety. Fifth, well-being was assessed using the 2 item Cantril Scale. The tool has also been found to be a valid measure when used as part of an evaluation of general well-being and productivity

(Prochaska et al, 2011). Though not a great deal is known about the tools validity/reliability, it can still provide a useful summary of people's capabilities and overall well being (Kahneman & Deaton, 2010). Participants with high raw scores would have high current wellbeing and hope about the future, while low raw scores would have low current wellbeing and little hope about the future. Anxiety, impulsivity, and wellness were all converted into t-scores to allow for an easier comparison between the various measures. See Figures 3 through 6 for a list of all of the various measures questions.

Stage of Change. Stage of Change for problematic gaming was measured using a question typically used to assess the stage of change for other behaviors (Prochaska & Velicer, 1997). The question asked participants whether or not they are ready to change and reduce their gaming use. More specifically, the question read as follows: "In the last month, have you played digital games for 20 hours or more in a week?" The responses were as follows: A. Yes, and I do not plan to reduce my digital game use (Precontemplation). B. Yes, but I plan to reduce my digital game use to less than 20 hours per week in the next six months (Contemplation). C. Yes, but I plan to reduce my digital game use to less than 20 hours per week in the next 30 days (Preparation). D. Not this month, but I have played digital games more than 20 hours per week in the last six months (Action). E. No, and I have not played digital games more than 19 hours per week in the past 6 months (Maintenance). F. No, and I have NEVER played digital games more than 19 hours per week (non-eligible participant). The response a participant provided determined if the participant was currently in Precontemplation, Contemplation, Preparation, Action, Maintenance, or was clearly a

non-eligible participant who had not clearly read the instructions. Fortunately, no participants answered this question in a non-compliant manner.

Decisional Balance of digital game use. This measure contained 24 items to assess both the Pros and Cons of reducing problematic game use. These questions were modeled from previous Decisional Balance questionnaires on problem behaviors such as smoking, as well as questionnaires incorporating healthy behaviors, such as weight reduction. The Pros questions tended to ask participants if they viewed potential positive impacts of gaming as important reasons to play digital games (e.g., "Digital games are a good way for me to spend time with family and friends.") Some of the Pros questions also addressed a potential absence of any negative impacts from digital gaming (e.g., "I can balance school and/or work activities and recreational digital game use without any problems.") The Cons questions tended to ask participants if they viewed potential negative impacts of gaming as important reasons to avoid playing digital games (e.g., "I feel uneasy when I am not playing digital games"). Some of the Cons questions also indicated common negative symptoms that many gamers would commonly experience (e.g., "Occasionally, I end up playing digital games longer than I expected.") According to previous TTM data (Hall & Rossi, 2008), problematic gamers in earlier stages of change (i.e., Precontemplation or Contemplation) would likely endorse higher Pros from their behavior and recognize lower Cons as important reasons to quit gaming, while previously problematic gamers in later stages of change (i.e., Action or Maintenance) would likely endorse lower Pros from gaming, and recognize higher Cons as important reasons to quit gaming.

Both the Pros and Cons measures were tallied to indicate a raw score of total Pros and a raw score of total Cons, where a higher score indicated a greater level of Pros or Cons. In turn, these raw scores were converted into T-scores for each participant. See Figure 1 for a listing of all of the Pro and Con questions, as well as the final questions included after the EFA and CFA trimmed some of the less useful items.

Self-Efficacy. In the TTM model, Self-Efficacy has been measured in two ways: situational confidence and situational temptations. In this study, Self-Efficacy was measured using 14 questions about temptations a current or former gamer may experience. Each question presented a variety of situations that would lead some individuals to become tempted to play digital games, such as being pressured by friends to play games, or having a stressful day. Questions were tallied to indicate a raw self-efficacy score, with high scorers endorsing being "Extremely tempted" by most or all of the temptation questions. These high scorers would thus have low Self-Efficacy due to having high temptations. On the other hand, low scorers would endorse being "Not at all tempted" or "Not very tempted" by most of the temptation questions. As such, low scorers would have high Self-Efficacy due to having low temptations. Similarly to the Decisional Balance questions, these raw scores were then converted into T-scores for each participant. Please see Figure 2 for a full listing of each Self-Efficacy question, as well as the questions included after the EFA and CFA trimmed some of the less useful items.

Hypothesis and Analysis

The current study aimed to determine whether the following hypotheses would to be supported by the results:

First, it was hypothesized that gamers who spend more time playing digital games are more likely to be problematic users (i.e., suffering negative impacts in their lives due to their gaming use). Second, it was hypothesized that previously problematic gamers currently in Action or Maintenance would endorse higher Cons than Pros when describing their past gaming use (as they would seem more likely to understand the negative consequences gaming previously had in their lives). Third, according to previous data, digital game users that spend less time playing games (i.e. the users that never played for excessive periods of time to begin with) would likely report low Pros and low Cons, as they would not perceive gaming as particularly beneficial, nor would they see a strong reason to reduce their gaming use if they were not suffering any negative effects from it. In contrast, gamers who spend excessive amounts of time gaming would report high Pros and low Cons, as these gamers would be more likely to believe their gaming was beneficial, and less likely to believe gaming was having any negative impacts in their lives (perhaps due to denial).

Measurement Development:

Exploratory phase. First, the sample of 319 participants was split in half, with about half of the participants randomly selected into an Exploratory Factor Analysis (EFA) for the Decisional Balance and Self-Efficacy scales. As some of the 319 participants did not complete all of the Decisional Balance and Self-Efficacy questions, the EFA consisted only of participants that answered all of the scale questions. In total, 104 participants were randomly selected into Decisional Balance, while 109 participants were randomly selected into Self-Efficacy. The EFA's allow for the ability to delete items that were not discriminating well among the participants

(Redding, Maddock & Rossi, 2006). Essentially, the goal of this step in evaluation was to determine the number of components present and estimate the correlations between them. Using a varimax rotation, the variance of the items were examined via a minimum average partial procedure (MAP), as well as a parallel analysis for the EFA. These procedures were chosen because research often indicates they are some of the most effective factor-extraction methods (Redding, Maddock, & Rossi, 2006) and these factor-extraction methods have been used in previous Decisional Balance and Self-Efficacy measures (Waterman et al., 2015). After the number of components to retain was decided, further micro-level analyses were also conducted. Specifically, factor loadings were analyzed, and those that had loadings less than .40, or complex items (e.g., loaded greater than .40 on more than one factor) were removed from the scale (Redding, Maddock & Rossi, 2006).

Second, two Confirmatory Factor Analyses (CFA's) were also conducted for the second half of the Decisional Balance and Self-Efficacy scales. Similarly to the EFA, only participants that responded to all of the Decisional Balance and Self-Efficacy questions were included, leaving 148 participants for Decisional Balance, and 141 participants for Self-Efficacy. For the CFA's, the maximum-likelihood estimation was used, as it is widely used and known to provide accurate results in the majority of situations (Levine, 2005). Model fit was determined by examining x^2, CFI, TLI, RNI, RMSEA, and SRMR, all of which can lead researchers to confidently claim the model represents the latent factor structure underlying the data well (Kline, 2005). If the model appeared to be a good fit from the indices, the next step would include an evaluation of coefficient Alpha, factor loadings, T-test, and standardized factor

loadings (effect size estimates).

Validation. First, the Decisional Balance and Self-Efficacy measures needed to undergo a sequential method for scale development. Such steps are needed to determine if the scales have merit and whether they appear to be both reliable and valid. Construct validity was demonstrated by the replication of the factor structure of the scales found in the Exploratory sample by the factor structures confirmed in the Confirmatory sample. Following these procedures, external validation of the scales was conducted by assessing known group validity. This is a robust method and is guided by previous research on the TTM given that there is not a recommended gold-standard "criterion" to validate the measures against at this point in time. Criterion-related validity was demonstrated with the known group validity if the scales functioned across Stage of Change in the expected patterns. For the Decisional Balance scale, the Pros and Cons were entered into a MANOVA to assess if they differ as expected based on TTM predictions by the Stage of Change. This MANOVA was also used to examine the second hypothesis. The Self-Efficacy scale questions were also entered into a MANOVA to demonstrate how it functioned across the Stages of Change. Additionally, the Pros and Cons and the Self-Efficacy scales were also examined via two ANOVA's to determine if there was a relationship between the amount of time spent gaming and the two TTM measures. Performing the Decisional Balance ANOVA also allowed for an examination of the third hypothesis (whether digital game users that spend less time playing games would report lower scores on both the Pros and Cons measures, and whether users with higher amounts of game use, especially those in Precontemplation, would report higher Pros and lower Cons). For

each of these analyses, the measures were converted into T-scores. Doing so allowed for more accurate comparisons across the Stages of Change among participants, as well as a comparison to other behaviors that have been studied by the TTM, as previous TTM measures and behaviors have also evaluated T-scores across the Stages of Change (Hall & Rossi, 2008).

It was expected to see similar patterns to those from previous studies with the typical cross over pattern of the Pros and Cons and an increase in Self-Efficacy across the Stages of Change (Hall & Rossi, 2008). If the data demonstrated a good match with the theory and parsimonious models were found, additional support for the scales would be demonstrated.

Reliability. In order to assess the reliability of the scales, internal consistency coefficient Alphas between .70 to .90 (in both halves of the data) were needed to demonstrate reliable scales. Other methods of reliability (e.g., test-retest) were not used in this sample as we were looking at dynamic constructs and expected to observe change over time. Additionally, considering the response burden for the population, methods such as alternate forms were also not used in this investigation.

Regardless of whether initial support for the reliability and validity were shown, the process would still not be complete. It would still be important to assess the measures in new samples, longitudinal studies, and possibly with more robust methods such as invariance testing. If the reliability and validity were not demonstrated, use of the measures would not be appropriate and further investigation into why the scales did not validate would be necessary to conduct.

Additional analyses. Following the examination of the Decisional Balance

and Self-Efficacy scales, another ANOVA was conducted to examine the first and third hypotheses, as the second was examined with a previously mentioned MANOVA. First, an ANOVA was conducted to determine if there was a statistically significant difference between the time spent gaming and problematic gaming means. Second, an ANOVA that examined Decisional Balance and time spent gaming was conducted to determine if there was a statistically significant difference between the participants Pros and Cons across stages of change when examining total time participants spent gaming. An additional ANOVA was also conducted to examine if the predictor questions were correlated with increased problematic gaming use. Last, a multiple regression analysis was conducted to explore whether anxiety, impulsivity, and wellness were effective predictors of problematic gaming.

CHAPTER 4

FINDINGS

Frequency of Use and Stages of Change

The 319 participants were first classified by their Stage of Change. The vast majority of participants (219) were in Precontemplation (68.7%), followed by 34 in Contemplation (10.7%), 16 in Preparation (5%), 37 in Action (11.6%), and 14 in Maintenance (4.4%). All participants had previously played or currently play digital games for 20 hours or more on a typical week.

The majority of participants currently play digital games between 20-29 hours (28.4%) or 30-39 hours (24.2%) on a typical week. 40 participants (12.1%) played between 40-49 hours, 25 (7.6%) played 50-59 hours, 13 (3.9%) played 60-69 hours, and 27 (8.2%) played 70 or more hours. 56 participants (16.9%) had previously played more than 20 hours on a typical week.

Exploratory Analysis

Decisional Balance. As previously mentioned, 104 participants were split into an EFA for the Decisional Balance scale. After analyzing factor loadings and cross loadings, the initial 24 item pool was reduced to 10 items. The 10 items were chosen based on having the highest factor loadings and also containing no problematic cross loadings. Five items assessed the level of Pros of digital game use, while the other five items assessed the level of Cons of digital game use. MAP and parallel analysis indicated that a two-component solution best described the Pros and Cons factors. The two factors had good to adequate item loadings ranging from .47 to .84 and contained a satisfactory number of items (five) (Guadagnoli and Velicer, 1988). Internal

consistency was calculated on the final items being run in a reliability analysis, while scale scores were derived from the sum of the individual item scores. These scales were shown to have adequate internal consistency (Pros $\alpha = 0.746$, and Cons $\alpha = 0.749$) and were correlated (.27). This final two-component solution showed good stability and accounted for 52% of the total item variance. Table 3 presents the items, exploratory factor loadings, and coefficient alpha for the Pros and Cons scales.

Self-Efficacy. As previously described, 109 participants were split into an EFA for the Self-Efficacy scale. After analyzing factor loadings and cross loadings, the initial 14 item pool was reduced to 6 items. The 6 items were chosen based on having the highest factor loadings and also containing no problematic cross loadings. Three items assessed mood changes (called the emotional Self-Efficacy scale) that might lead to temptations (indicating low Self-Efficacy), while the other three items assessed broader temptations (called the general Self-Efficacy scale), which included such temptations as cravings or dealing with other gamers trying to encourage digital game use (also indicating low Self-Efficacy). MAP and parallel analysis indicated that a two-component solution best described the two Self-Efficacy factors. The two factors had good to adequate item loadings ranging from .58 to .90 and contained a satisfactory number of items (three) (Guadagnoli and Velicer, 1988). Internal consistency was calculated on the final items being run in a reliability analysis, while scale scores were derived from the sum of the individual item scores. These scales were shown to have good to low internal consistency (general $\alpha = 0.833$ and mood $\alpha = 0.594$) and were correlated (.23). This final two-component solution showed good

stability and accounted for 66% of the total item variance. Table 3 presents the items, exploratory factor loadings, and coefficient alpha for the self-efficacy scales.

Confirmatory Analysis

Decisional Balance. As previously described, 148 participants were split into a CFA for the Decisional Balance scale. In this random sample, three models were tested: (1) null model (suggesting no latent factors and used as a comparative model), (2) two uncorrelated Pros and Cons factors, and (3) two correlated Pros and Cons factors. The two-factor correlated model demonstrated the best fit, χ^2 (34) = 51.14, $p <$ .05, CFI = .98, GFI = .95, and AASR = .04. Factor loadings ranged from .46. to .84, and internal consistency (which was calculated on the final items being run in a reliability analysis) was adequate to slightly low (Pros $\alpha = 0.745$, and Cons $\alpha = 0.688$). The correlation between the Pros and Cons scales was .48. The confirmatory factor loadings and coefficient alpha for both samples are presented in Table 3.

Self-Efficacy. As previously described, 141 participants were split into a CFA for the Self-Efficacy scale. In this random sample, three models were tested: (1) null model (suggesting no latent factors and used as a comparative model), (2) two uncorrelated Self-Efficacy factors, and (3) two correlated Self-Efficacy factors. The two-factor correlated model demonstrated the best fit, χ^2 (8) = 19.3, $p < .01$, CFI = .95, GFI = .96, and AASR = .04. Factor loadings ranged from .40 to .89, and internal consistency (which was calculated on the final items being run in a reliability analysis) was good to slightly low (general $\alpha = 0.794$, and cons $\alpha = 0.605$). The correlation between the Pros and Cons scales was .55. The confirmatory factor loadings and coefficient alpha for both samples are presented in Table 3.

External Validation

A MANOVA was conducted on the final Pros and Cons scales to examine differences across the Stages of Change. This MANOVA also allowed for an examination of the second hypothesis, which will be described in more detail in a separate section. As previously mentioned, the MANOVA analyzed converted T-scores of all four scales. MANOVA results were also run a second time weighing T-scores based on stage of change proportions to equalize the distribution and allow for more accurate comparisons across the Stages of Change, which has been utilized in previous TTM studies (Waterman et al., 2015). Results with weighed T-scores indicated that the Decisional Balance Pros and Cons scales did not have statistically significant differences in means across the Stages of Change F (8, 256) = 1.12, p = .351. Unweighted T-scores were also found to be non-significant differences in means across the Stages of Change.

Likewise, weighted T-score MANOVA results of the general and emotional Self-Efficacy scales did not have statistically significant differences in means across the Stages of Change F (8, 253) = 1.94, p = .053. However, while the general Self-Efficacy scale was not significant F (4, 256) = 1.26, p = .285, the emotional Self-Efficacy scale had statistically significant differences in means across the Stages of Change F (4, 256) = 2.99, p = .02. In other words, participants who reported having low emotional temptations to play digital games were significantly more likely to be in Action or Maintenance. Of further note, participants in Preparation reported even higher emotional Self-Efficacy scores (M = 57.3) than participants in Precontemplation (M = 50.1) or Contemplation (M = 51.8), indicating that participants

in Preparation felt more tempted by emotional cues to play digital games (perhaps because they had developed more insight into the factors that led to their cravings to play digital games). Unweighted T-scores also led to no significant differences in results

Table 4 contains the MANOVA main results for both the Decisional Balance and Self-Efficacy measures. Additionally, Figures 7 and 8 provide T-score mean plots for each of the four scales (Figure 7 contains the Decisional Balance scales, while Figure 8 contains the Self-Efficacy scales).

Hypotheses Findings

Problem gaming and time spent gaming. To answer the first hypothesis, an ANOVA was conducted to determine if there was a statistically significant differences in mean scores when comparing time spent gaming (an ordinal measure from 1 to 8, where 1 indicated less than 20 hours of gaming per week, and 8 indicated more than 70 hours per week) and the T-scores of the problematic effects associated with gaming (converted from raw scores of both severity and number of problematic gaming effects noted) were compared. ANOVA results indicated a statistically significant difference in T-scores of problematic gaming depending on the amount of time spent gaming $F(6, 247) = 5.10$, $p < .00$. Unexpectedly, participants who played digital games for 60-69 hours per week reported the highest problematic scores (T = 61.4) which was decidedly higher than the participants who played 70 hours or more (T = 54.7).

Figure 9 provides the T-score plots of the problem gaming and time spent gaming ANOVA. As previously noted, original raw scores of reported problematic effects were created by adding together the severity and number of reported symptoms

of each problematic effect reported from the Lemmens Game Addiction scale. In other words, participants that reported no problematic symptoms (i.e., reporting "Never" to each problematic gaming question) would receive a score of 7, while participants that reported the highest severity of problematic symptoms (i.e., reporting "Very often" to each problematic gaming question) would receive a score of 35. These scores were then converted into T-scores.

Problem gaming and Decisional Balance. To answer the second hypothesis, the MANOVA results from the "external validation" section were examined. The second hypothesis was that gamers who previously struggled with problematic amounts of use (those in Action or Maintenance) would likely endorse higher levels of Cons than Pros when describing their previous gaming use. These MANOVA results indicated that the Decisional Balance Pros and Cons scales did not have statistically significant differences in mean T-scores across the Stage of Change F (3, 261) = 1.12, p = .351. Regardless of the Stage of Change a participant was in, the T-scores of both Pros and Cons tended to be quite similar. Although participants in Action or Maintenance did appear to have slightly higher T-score Cons than T-score Pros, it did not reach the point of statistical significance (see Figure 1). Table 4 contains the key findings of this MANOVA. Figure 7 and 8 contain the T-score plots of both the Pros and Cons scales.

Time spent gaming and Decisional Balance. To answer the third hypothesis, an additional ANOVA was conducted. This ANOVA also examined the means between time spent playing digital games and the T-scores of the Decisional Balance/Self-Efficacy measures. Like the MANOVA, the ANOVA examined

converted T-scores of each of the four scales. The ANOVA results indicated that the Decisional Balance Pros scale did not have statistically significant differences in T-score means across the amount of time spent gaming F (6, 263) = .756, p = .605. However, the Decisional Balance Cons scale was found to be statistically significant, indicating that the Cons T-score had significantly different means depending on the amount of time spent gaming F (6, 263) = 3.252, p = .004.

Additionally, a second ANOVA was also conducted to examine the relationship between time spent gaming and Self-Efficacy. The second ANOVA results indicated that the Self-Efficacy general scale T-score means did not have statistically significant differences on the amount of time spent gaming F (6, 259) = 2.095, p = .054. The Self-Efficacy emotional scale also did not have statistically significant T-score mean differences on the amount of time spent gaming F (6, 259) = .80, p = .571. These findings indicated that only the Cons Decisional Balance scale was impacted by the amount of time a person spent playing digital games, while the other three TTM constructs had similar T-scores regardless of the amount of time participants spent playing digital games.

Figure 10 presents the mean plots of the time spent gaming and Decisional Balance ANOVA, while Figure 11 presents the mean plots of the time spent gaming and Self-Efficacy ANOVA.

Time Spent Gaming and Previous Predictors of Pathological Use.

An additional ANOVA was conducted to examine if two previous predictors of problematic gaming use were also effective predictors of problematic gaming in the current sample. Results indicated a statistically significant increase in problematic

gaming mean T-scores if participants indicated they experienced lack of control of digital gaming F (6, 247) = 17.90, $p < .00$, and lack of success in other life activities besides digital gaming F (6, 247) = 8.91, $p < .00$.

Further, a stepwise Multiple Regression Analysis was conducted to examine if anxiety, impulsivity, and wellness were effective predictors of problematic digital gaming use. Anxiety, impulsivity, and wellness were all continuous variables, with higher raw scores indicating higher amounts of anxiety, impulsivity, and wellness. These raw scores were then converted into t-scores, with higher t-scores indicating higher amounts of anxiety, impulsivity, and wellness.

In the stepwise regression, impulsivity and wellness were found to reveal a medium shared variance effect size, with an R^2 of .173 and a statistically significant effect size $F(2, 149) = 15.46$, $p < .00$. Additionally, the standardized β regression coefficients from the stepwise MR are provided in table 6, where impulsivity (β = 0.28) and wellness (β = -0.22) each showed near medium effect sizes close to 0.30, while the β coefficient for anxiety was negligible and non-significant (β = 0.05). As anxiety was not found to contribute as a good predictor of problematic digital gaming use when examined with impulsivity and wellness, it was automatically removed by stepwise analysis. These results indicated that examining both impulsivity and wellness were better at predicting problematic gaming use, with higher degrees of impulsivity and lower wellness indicating a greater probability of a participant having a high problematic gaming T-score.

The last predictor, type of game played most frequently, ended up being more problematic than expected. It was not feasible to run a statistical significance test on

this question because many participants endorsed playing multiple types of games for about even amounts of time. As such, it was not possible to determine whether certain types of games led to more problematic symptoms than other types of games.

Table 5 contains key data on all other ANOVA's that are predictors of pathological digital gaming use, with the exception of type of game played most frequently, in which case an analysis could not be properly run. Table 6 contains key data on the Multiple Regression Analysis.

CHAPTER 5

CONCLUSION

Hypotheses Findings

Although certain results were consistent with previously aforementioned hypotheses and research, some unexpected results also occurred. The first hypothesis indicated that digital gamers who spent longer periods of time playing digital games would also report higher degrees of problems associated with their gaming use. As expected, the ANOVA results indicated a statistically significant relationship between the means of these two variables. In other words, digital gamers who spend extended periods of time playing digital games are more likely to report problematic symptoms from their digital gameplay. This is an important finding, particularly because participants who reported 40 hours or more of gameplay per week reported far more problematic symptoms than participants who reported 20-39 hours of gameplay per week.

The other two hypotheses were more difficult to address due to some potential issues with the Decisional Balance measures. The second hypothesis was that previously problematic digital gamers (the participants in Action or Maintenance) would potentially endorse higher Cons than Pros when describing their previous gaming. This was tested by a MANOVA, but the Action and Maintenance participants were not statistically more likely to endorse higher levels of Cons than Pros compared to the participants in Precontemplation, Contemplation, or Preparation. Overall, the T-scores of the Pros and Cons scores did not have significantly different means, regardless of which Stage of Change a participant was in. As can be seen in Figure 1,

the Pros means decreased slightly from Precontemplation to Maintenance, but not enough to be statistically significant. Further, the Cons means increased in Preparation, while they decreased in Action and Maintenance. Had the Cons means declined in Preparation, there may have been a statistically significant pattern, but this was not found to be the case. It would have been expected that previously problematic gamers would believe there were fewer positive reasons to play digital games (hence why they would experience a decline in reported Pros), but the variations in Cons increasing in Preparation and then decreasing in Action and Maintenance was a very peculiar finding. Such a finding seems to indicate only minor changes in Cons means across Stages of Change, but it is also possible these findings were due to the somewhat small number of participants found in Action or Maintenance.

Although the MANOVA that examined Decisional Balance did not find very promising results, it is worth noting that the examination of Self-Efficacy found some significant results. The MANOVA found that participants in Action or Maintenance were significantly less likely to feel tempted to play digital games when facing emotional temptations (see Figure 8). On the other hand, participants in Precontemplation, Contemplation, or Preparation endorsed much higher temptation to play digital games when facing these emotional temptations. Participants in Preparation were especially likely to believe they would have a difficult time with these temptations, possibly due to their increased insight into the difficulty they have controlling their gaming use when exposed to various emotional triggers.

The third hypothesis was that digital game users that spend less time playing games (i.e. the users that never played for excessive periods of time to begin with)

would likely report a low level of Pros and Cons, as they would not perceive gaming as particularly beneficial, nor would they see a strong reason to reduce their gaming use if they were not suffering any problematic effects from it. In contrast, gamers who spend excessive amounts of time gaming would report high levels of Pros and low Cons, as these gamers would be more likely to believe their gaming was beneficial, and less likely to believe gaming was having any problematic impacts in their lives (perhaps due to denial). The time spent gaming and Pros analysis indicated there was not a statistically significant difference in the number of Pros endorsed by gamers who spent longer periods of time playing digital games. Nevertheless, participants with less time spent gaming did tend to report lower mean scores on both the Pros and Cons measures (see Figure 10). This may be because gamers that have reduced their gaming use begin to believe there are few benefits to their gaming, and also believe they experience few negative impacts from their current low amounts of gaming use (or from their complete abstinence from digital gaming). As shown in Figure 10, participants that played more than 40 hours a week tended to report higher mean Pro scores than the gamers that played less often. The only exception were the digital gamers that played 60-69 hours a week, as they strangely reported much lower mean Pro scores than the other gamers who spent a lot of time playing digital games. The time spent gaming and Cons analysis indicated there was a statistically significant difference in the level of Cons endorsed by participants with high amounts of digital game use and participants with lower amounts of use. As shown in Figure 10, participants reporting low amounts of gaming were significantly more likely to report low mean Con scores, while participants reporting high amounts of gaming use were

much more likely to report high mean Con score and high mean Pro scores. In other words, the hypothesis was only partially correct, as participants with less time spent gaming did tend to report lower mean scores on both the Pros and Cons measures. However, participants with high amounts of gaming use reported higher levels of Cons than participants with low amounts of gaming, while the level of Pros did not seem to have any definitive impact on the amount of time spent gaming (although participants that played more than 40 hours a week tended to report higher mean Pros than the gamers that played less often).

According to previous research on behavior change of reducing a negative behavior (Hall & Rossi, 2008), participants with higher amounts of problematic use would be more likely to be in Precontemplation, and thus believe there were few good reasons (Pros) to change their problem behavior, and many bad reasons (Cons) to change the behavior. In turn, the further along a person is in their Stage of Change, the more likely they are to begin seeing more good reasons to change their behavior, and fewer negative reasons to change their behavior. The same assumptions could mostly be made for the area of problematic gaming, but the MANOVA results looked quite different. These results may also be due to gaming participants with lower amounts of use reporting lower Cons because gaming is less of a problem for them in the first place. Although some of the gaming participants who report low amounts of gaming use were in Action or Maintenance, many of these low reporting participants (the gamers who currently play between 20-39 hours a week) may not believe there are many Cons to their gaming, perhaps because they have avoided especially problematic consequences from their gaming use. In contrast, the gamers spending 40-70 or more

hours on an average week playing digital games may experience far more problematic consequences.

Measures and Other Noteworthy Findings

An additional ANOVA found neither of the two Self-Efficacy measures to have their means significantly impacted by the amount of time spent gaming. Even so, as shown in Figure 8, the general Self-Efficacy measure was very close to having an impact on mean scores, as digital gamers spending 20-39 hours gaming a week appeared to have higher general Self-Efficacy mean scores than the gamers spending more than 40 hours a week gaming. A higher general Self-Efficacy score indicates that a participant feels able to avoid gaming when exposed to various triggering situations that might trigger gamers with lower self-control. The emotional Self-Efficacy measure, despite showing statistical significance through the MANOVA, seemed less effective when evaluating time spent gaming, as most participants reported similar emotional Self-Efficacy scores. The only exception were the participants that spent 60-69 hours a week, who surprisingly reported lower emotional Self-Efficacy scores than any other group (including the participants that spent 70 hours or more a week playing digital games). Although this may indicate a different pattern than most other behaviors utilizing Self-Efficacy measures, it is likely this was due to some degree of error.

The exploratory and confirmatory factor analyses seemed to indicate some promise in the Decisional Balance and Self-Efficacy measures. All measures had overall strong factor loadings, with even the weaker items being of adequate quality (with factor loadings of .40 or higher). The potential issue with these measures is their

internal consistency, which was not as high as expected. During the EFA, 3 of the 4 factors had adequate Cronbach alpha's between .75 and .83, while the 4th factor (self-efficacy mood) had a Cronbach alpha of .6, which is lower than expected. During the CFA, 2 of the 4 factors had adequate Cronbach alpha's between .75 and .8, while the other two factors (self-efficacy general and decisional balance cons) had Cronbach alpha's of .6 and .67, also lower than expected. Although further improvement will be necessary on these measures, these initial results indicate good factor loadings and good potential if the internal consistency can be improved.

Although the MANOVA results were primarily not found to be significant (with the mood Self-Efficacy factor being the only statistically significant difference in means when examining T-scores and Stage of Change), T-score mean plots seemed to indicate that participants in the Action or Maintenance stages tended to report lower Pros and lower Cons of digital gaming use than participants in Precontemplation or Contemplation (see Figure 7). Since these results were not statistically significant, it will be important to obtain another sample of participants before the measures are fully completed.

Moving to the additional ANOVA findings, it was found that nearly every problem variable led to statistically significant mean differences in time spent gaming. Problematic gaming, lack of life success in other life areas, inability to control gaming use, anxiety, impulsivity, and wellness all had statistically significant associations with time spent gaming. In other words, higher mean scores of these various problematic symptoms indicated higher amounts of time spent playing digital games, while lower mean scores in wellness indicated higher amounts of time spent playing digital games.

These findings are not too surprising based on previous research, but are still quite useful in replicating the findings of previous studies. Additionally, these findings indicate that these variables are significantly related to problematic use of digital games.

Last, Multiple Regression Analysis was conducted to examine the relationships of impulsivity, anxiety, and wellness to problematic gaming. The analysis determined that high impulsivity mean scores had the strongest relationship to problematic gaming, although high impulsivity and low wellness mean scores combined were also significantly related to problematic gaming. Anxiety was not found to be related to problematic gaming and did not add any value to the Multiple Regression Analysis. This was a somewhat unexpected finding given the previous ANOVA findings on the statistical significance of problematic gaming use mean scores increasing as mean anxiety scores increased.

It is also noteworthy that anxiety was significantly related to time spent gaming, but not to problematic gaming use, despite the high similarity between the two variables.

Limitations

First, although the factor loadings were adequate to strong for both the Decisional Balance and Self-Efficacy measures across both the exploratory factor analysis and the confirmatory factor analysis, the internal consistency was adequate at times, but also lower than expected at times. This may have been a result of having relatively few items for the various measures (particularly the Self-Efficacy scales), but was more likely was due to the sample size being a bit smaller than anticipated.

Although the total sample size was slightly above the initial expectations of 300 participants (it originally contained 319 total participants before removing a few extremely careless responders), the sample size for developing the Decisional Balance and Self-Efficacy measures became lower than expected. To create the most accurate measure possible, participants that left any items on the Decisional Balance or Self-Efficacy measures were removed from the exploratory or confirmatory factor analyses. After doing so, this left the exploratory factor analyses with 104 (decisional balance) and 109 (self-efficacy) participants, while the confirmatory factor analyses contained 148 (decisional balance) and 141 (self-efficacy) participants. These numbers, especially for the exploratory factor analyses, are lower than the usual recommendations for conducting EFA's and CFA's, which is typically at least 150 (Harlow, 2014). Fortunately, the CFA's were quite close to this 150 sample size recommendation, but a larger sample size for the EFA's would be advisable for future samples.

Second, as previously mentioned, some of the internal consistency measures on the Decisional Balance and Self-Efficacy factors had a Cronbach's alpha a bit below .70, even though the majority of factors were .70 or above during the CFA's and EFA's (5 out of 8), three of them were below .70. Testing these questions out again with a larger sample may allow for higher internal consistency, and adding a few additional strong questions longer may also increase the consistency.

The final and largest limitation was the phrasing of some of the Decisional Balance instructions, which may have led to some inaccurate reporting by participants who misunderstood or were confused by the instructions. For instance, a number of

the Decisional Balance questions were written in the past tense. One of the questions was, "I have suffered physical pain from digital games." This should have had no bearing on the results of participant responses, as the instructions stated that the participant should discuss how important the issue is to them *currently* in whether they avoid playing digital games. In other words, if a participant suffered from physical pain from playing digital games in the past, they may not currently view it as an important reason to avoid playing digital games. Even so, it is likely that some of the respondents became confused by the Decisional Balance questions and responded to how important the issue was to them in the past rather than the present. It is likely that this problem can be rectified in the future by making the Decisional Balance instructions simpler and clearer.

Implications and Future Directions

The findings of this dissertation provide a number of noteworthy implications for the field of problematic digital gaming. First, it was originally believed that 20 hours per week playing digital games indicated at least some degree of risk in becoming a problematic gamer. However, in the findings, 40 hours per week seems to indicate a much higher probability of experiencing problematic symptoms from digital gaming. Although the results indicated that amount of time spent playing digital games was strongly correlated with problematic gaming, it was not clear that the gamers currently playing relatively low amounts of time (i.e. 20-29 hours a week) were at risk of becoming problematic gamers. A number of these participants did report at least a few problematic symptoms from their gaming, but quite a few also endorsed no negative impacts from their gaming.

A major concern when doing innovative research on a new behavior is a lack of a consensus on what criteria should be used to define the behavior. Traditionally, public health has started with less stringent criteria (e.g., 5 servings of fruits and vegetables per day) and then progressed more stringent criteria such as the 5 cups or 9 servings per day. One problem with less stringent criteria is that a high percentage of a population will be in Precontemplation in part because they may not be experiencing any serious problems. A problem with more stringent criteria is that it will be difficult to help a high percentage to progress to Action and Maintenance.

In the present study, 20 hours per week was seen as a starting point, and found a high percentage of participants were in Precontemplation, and there wasn't a significant difference in number of problems. The results strongly indicate that this program of research should progress to 40 hours per week, where there is clearly a significant increase in number of problems.

Another important implication is that although the Decisional Balance and Self-Efficacy measures will likely need further data before their full completion, the current findings indicate that these tools could be beneficial in applying the TTM to a new and extremely important field. The emotional Self-Efficacy scale appears to show the most current value, as it was statistically significant when examining Stage of Change and problematic gaming use. In other words, participants in the Action or Maintenance stages felt less temptations when handling emotional gaming issues than participants in Precontemplation, Contemplation, or Preparation (see Figure 2). The Decisional Balance Cons scale also shows some value due to its statistical significance when examining the amount of time participants were playing digital games (gamers

who played for longer periods of time reported more Cons). The general Self-Efficacy scale also came very close to statistical significance. The Decisional Balance Pros scale had the most problematic results, which were likely a result of the various concerns discussed in the limitations section.

With further refinement, it is likely that all scales will prove valuable in differentiating gamers with high amounts of use from gamers with lower and less problematic amounts of use. These two measures of digital gaming are the first of their kind to explore both the Pros and Cons of digital gaming, and could become quite useful in developing a better understanding of whether or not a digital game user is at risk or is suffering enough problematic digital gaming effects that they would likely benefit from cutting back on their use. As the TTM has been applied to help many clients and patients reduce problematic behaviors or increase positive behaviors (Prochaska and Velicer, 1997; Hall & Rossi, 2008; Noar, Benac, & Harris, 2007), it is likely that utilizing these same techniques to assess and treat problematic digital gamers will also be of benefit. Additionally, including questions that assess both the Pros and Cons of digital gaming will allow digital gamers in Precontemplation to become more cooperative if they realize the assessment tools are also accounting for some of the benefits digital games might be providing them.

The dissertation also provided further evidence that the amount of time spent playing digital games is clearly related to many problematic symptoms, including anxiety, impulsivity, and low wellbeing. Upon further analysis, it may be possible to develop a better understanding of how many hours need to be spent playing digital games before problematic symptoms develop. It would likely vary from individual to

individual, but it would be safe to assume that even a very healthy individual who spent 40 hours a week playing digital games would simply not have enough time to function as effectively socially, academically, or occupationally. This does not mean that digital gaming will always have problematic effects, especially among gamers who simply play digital games for a few hours each day after work or school about 3 hours per day (adding up to slightly more than 20 hours a week). This data certainly seems to indicate that these digital gamers with lower amounts of use tend to have less problematic symptoms, higher wellbeing, lower anxiety, and lower impulsivity. Although they reported about as many Pros as the more problematic gamers, it seems likely from these findings that they also experience lower Cons from their gaming use.

In terms of future studies, it is likely that the current data can still be used to attempt to answer some other important research questions. For instance, do problematic gamers have lower Self-Efficacy than the non-problematic gamers or previously problematic gamers that are currently in Action or Maintenance? Further, it might be possible to examine which of the many predictors in this study serve as the most effective predictors of problematic gaming. Although this was partially examined via the Multiple Regression Analysis, not all of the variables could be examined in this manner due to some of the variables being continuous rather than categorical. Ideally, after examining all variables, the best predictors, along with the Decisional Balance and Self-Efficacy questions, would allow for the development of a more accurate measurement of problematic gaming than previous measures.

It might also be possible to evaluate some factors that may be protective factors in preventing problematic digital gaming use. Is education a protective factor?

Are hard working students or employees with busy and demanding work schedules less likely to become problematic digital gamers? It may be possible to use the current data to explore some of these extremely important questions.

An additional future study could involve examining some additional valuable data that may predict digital game users who are either currently problematic users, or at risk of becoming problematic users. The additional study could be longitudinal, and could also examine at what age a user first began to play digital games, as digital gamers who started playing at younger ages would likely be at a higher risk of becoming problematic digital gamers in the future.

Finally, other valuable future studies would involve continuing to improve the Decisional Balance and Self-Efficacy measures, particularly in terms of improving internal consistency via a larger sample size that has more participants in the other Stages of Change. Certain instructions could also be redesigned in order to avoid potential confusion among the participants, such as the somewhat confusing Decisional Balance instructions. Since it would likely be very difficult to find a large sample of participants in Action or Maintenance online, a follow-up study would likely need to recruit participants via university settings. With a larger number of participants in Action and Maintenance, it might also be possible to compare these previously problematic gamers with their currently problematic peers and see if their anxiety, impulsivity, and wellness are lower than their peers who are still experiencing problematic effects from their gameplay.

TABLE 1: SUMMARY OF DEMOGRAPHICS

Sex	
Male	96.2%
Female	3.8%
Race/Ethnicity	
Native American	0.3%
Asian or Pacific Islander	13.1%
Hispanic or Latino	4.5%
White	81.4%
Black or African American	2.4%
Other	1.7%
Highest Degree	
Doctoral Degree	2.4%
Professional Degree	1%
Master's Degree	8.6%
Bachelor's Degree	30.8%
Associate Degree	2%
Trade/Technical/Vocational	2%
Some College Credit, No Degree	30.1%
High School Graduate or GED	21.6%
Did Not Complete High school	1.4%

TABLE 2: SUMMARY SOC AND FREQUENCY GAMING USE

Stage of Change	
Precontemplation	68.7%
Contemplation	10.7%
Preparation	5%
Action	11.6%
Maintenance	4.4%
Frequency of Use	
Currently Less Than 20 Hours	16.9%
20-29 Hours Average Week	28.4%
30-39 Hours Average Week	22.2%
40-49 Hours Average Week	12.1%
50-59 Hours Average Week	7.6%
60-69 Hours Average Week	3.9%
70 or Greater Hours Average Week	8.2%

TABLE 3: DECISIONAL BALANCE AND SELF-EFFICACY SCALE ITEMS, FACTOR LOADINGS AND COEFFICIENT ALPHAS

Scale	Item	EFA Loadings	CFA Loadings
Pros	Digital games are a good way for me to relieve stress	0.468	0.632
	Digital games have improved my hand-eye coordination	0.796	0.727
	Digital games have improved my problem-solving abilities	0.840	0.841
	Digital games have helped improve my planning abilities	0.758	0.603
	I can learn more effectively using digital games (for example, playing a game that teaches math skills)	0.580	0.633
		0.746	0.745
Cons	I am unable to focus on activities that are not related to digital games.	0.748	0.583
	I feel uneasy when I am not playing digital games	0.782	0.528
	I have a hard time going more than a day or two without playing digital games	0.674	0.640
	I find there are times I show up	0.700	0.501
		0.655	0.464

	late to school or work due to playing digital games	0.749	0.668
	There have been times I've been unable to sleep due to thoughts about digital games		
SE Mood	If I am worried about something	0.768	0.647
	If I feel depressed	0.869	0.888
	If I feel frustrated	0.900	0.764
	SE Mood coefficient alpha	0.594	0.794
SE General	If I have the sudden urge to play digital games.	0.798	0.683
	If I dream about playing digital games.	0.825	0.678
	If friends or other people I know encourage me to play digital games.	0.573	0.400
	SE General coefficient alpha	0.833	0.605

T**ABLE 4: MAIN MANOVA FINDINGS**

	Partial η^2	df	Value/MS	F	Sig.
Decisional Balance and Stages of Change	.02	8	.97	1.12	.35
DB Pros	.012	4	80.71	.80	.52
DB Cons	.023	4	151.95	1.55	.19
Self-Efficacy and Stages of Change	.030	8	.94	1.94	.05
SE Gen	.02	4	136.52	1.26	.29
SE Emo	.05	4	300.66	2.99	.02

TABLE 5: ALL ANOVA FINDINGS

Time Spent and Problem Gaming	SS	df	MS	F	Sig.
Between	679.668	6	113.278	5.095	.000
Within	5491.659	247	22.233		
Total	6171.327	253			
Time Spent and Decisional Balance Pros					
Between	456.232	6	76.039	.756	.605
Within	25843.768	257	100.559		
Total	26300.000	263			
Time Spent and Decisional Balance Cons					
Between	1855.952	6	309.325	3.252	.004
Within	24444.048	257	95.113		
Total	26300.000	263			
Time Spent and Self-Efficacy Emo					
Between	482.163	6	80.361	.800	.571
Within	25417.837	253	100.466		
Total	25900.00	259			
Time Spent and Self-Efficacy Gen					
Between	1225.887	6	204.315	2.095	.054
Within	24674.113	253	97.526		
Total	25900.000	259			

Problem Gaming and Lack of Control					
Between	1870.426	6	311.738	17.903	.000
Within	4300.901	247	17.413		
Total	6171.327	253			
Problem Gaming and Lack of Success					
Between					
Within	1098.141	6	183.024	8.911	.000
Total	5073.186	247	20.539		
Problem Gaming and Total Anxiety	6171.327	253			
Between					
Within					
Total	1004.899	16	62.806	3.029	.000
Problem Gaming and Total Impulse	3047.607	147	20.732		
	4052.506	163			
Between					
Within	1521.545	29	52.467	2.541	.000
Total	4252.692	206	20.644		
Problem Gaming and Total Well	5774.237	235			
Between					
Within	572.237	24	23.843	2.503	.000
Total	2161.997	227	9.524		
	2734.234	251			

TABLE 6: MULTIPLE REGRESSION IMPULSIVITY WELLNESS ANXIETY (ANXIETY EXCLUDED)

		95% C.I.		
	Odds Ratio	Lower	Upper	Sig
Model	47.623	34.774	60.472	.000
Impulsiv	.275	.119	.432	.001
Wellness	-.216	-.369	-.063	.006

The following statements represent different opinions about playing digital games. Please rate HOW IMPORTANT each statement is to your decision to play digital games. For example, if the statement was "I have a hard time not playing digital games" and you felt this statement was a very important reason you try to avoid playing digital games too often, you would select "Very Important." If you felt this statement did not apply to you, or felt it had no impact on your digital game play, you would select "Not Important."

1. I have made a lot of friends through playing digital games. (P).
2. I am unable to focus on activities that are not related to digital games. (C).*
3. Digital games are a good way for me to relieve stress. (P).*
4. I feel uneasy when I am not playing digital games (C).*
5. I have a great deal of fun when using digital games (P).
6. Digital games have improved my hand-eye coordination (P).*
7. I get into arguments with my friends and family over my digital game use (C).
8. Digital games have caused me to neglect other important responsibilities (C).
9. Digital games have improved my problem-solving abilities (P).*
10. I have suffered physical pain from digital games (such as carpal tunnel syndrome, wrist or neck injuries, etc). (C).
11. I have a hard time going for more than a day or two without playing digital games (C).*
12. There are times I've gotten frustrated while playing digital games (C).
13. I engage less in other activities because I would prefer to play digital games (C).
14. I have experienced more positive effects from digital games than negative effects. (P).
15. Digital games have helped improve my planning abilities (P).*
16. I have spent a great deal of money on digital games and/or digital game products (C).
17. I find there are times I show up late to school or work due to playing digital games (C).*
18. I have made a good amount of money playing digital games (P).
19. I can balance school and/or work activities and recreational digital game use without any problems (P).
20. There are times I've been unable to sleep due to thoughts about digital games (C).*
21. I can learn more effectively using digital games (for example, playing a game that teaches math skills). (P).*
22. Occasionally, I end up playing digital games longer than expected. (C).
23. I use digital games that provide exercise (such as "Dance Dance Revolution"), so it's a great way to get exercise. (P)
24. Digital games are a good way for me to spend time with family or friends. (P).

*=Questions included in final measure (P=Pro, C=Con).

Figure 1. Decisional Balance measure.

How tempted would you be to start playing digital games in the following situations?

1. If I am worried about something. (M)*
2. If I see others playing digital games.
3. If I have gone a while without playing digital games.
4. If I have a sudden urge to play digital games. (G)*
5. If I dream about playing digital games. (G)*
6. If friends or other people I know encourage me to play digital games. (G)*
7. If I feel physically tired.
8. If I feel depressed. (M)*
9. If I feel frustrated. (M)*
10. If I want to test my will power and show that I can easily control my digital game playing.
11. If I want to have a good time with others.
12. If I'm using the computer for other purposes (such as to do work or communicate with friends).
13. If I have trouble sleeping.
14. If I want to reward myself for a job well done.

*=Questions included in final measure. M=Mood, G=General.

Figure 2 Self-Efficacy measure

The following questions are related to your digital game use. Please remember
that "digital game use" can refer to all types of games played electronically, including
video games, computer games, smartphone games, etc. Please choose the response you feel best describes your digital game use in the PAST SIX MONTHS
by selecting one of the responses to the right of the question**.**

1.How often in the last six months did you think about digital games all day long?
2. How often in the last six months did you spend increasing amounts of time on digital games?
3. How often in the last six months did you play digital games to forget about real life?
4. How often in the last six months have others unsuccessfully tried to reduce your digital game use?
5. How often in the last six months have you felt bad when you were unable to play digital games?
6. How often in the last six months did you have fights with others (such as family, friends) over your time spent on digital games?
7. How often in the last six months have you neglected other important activities (such as work, school, sports) to play digital games?

Figure 3. Lemmens questionnaire (problematic gaming measure).

1.In the past week, how often have you felt anxious?

2. In the past week, when you have felt anxious, how intense or severe was your anxiety?

3. In the past week, how often did you avoid situations, places, objects, or activities because of anxiety or fear?

4. In the past week, how much did your anxiety interfere with your ability to do the things you needed to do at work, at school, or at home?

5. In the past week, how much has Anxiety interfered with your social life and relationships?

Figure 4. Oasis measure (anxiety measure).

People differ in the ways they act and think in different situations. These questions are intended to measure some of the ways in which you act and think. Read each statement and select the appropriate circle to the right of the question. Do not spend too much time on any statement. Answer quickly and honestly.

1. I act "on impulse."
2. I plan for job security.
3. I act on the spur of the moment.
4. I do things without thinking.
5. I plan for the future.
6. I save regularly.
7. I say things without thinking.
8. I buy things on impulse.
9. I am a careful thinker.
10. I plan tasks carefully.
11. I am restless at lectures or talks.
12. I squirm at plays or lectures.
13. I concentrate easily.
14. I don't pay attention.
15. I get easily bored when solving thought problems.

Figure 5. Barratt impulsiveness measure (impulsivity measure).

1. Please imagine a ladder with steps numbered from zero at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time? Please enter in the box below the number that is closest to where you feel you stand at this time.

2. Using the ladder example above a second time, on which step do you think you will stand about five years from now? Please enter in the box below the number closest to where you will stand.

Figure 6. Cantrill Scale (wellness measure).

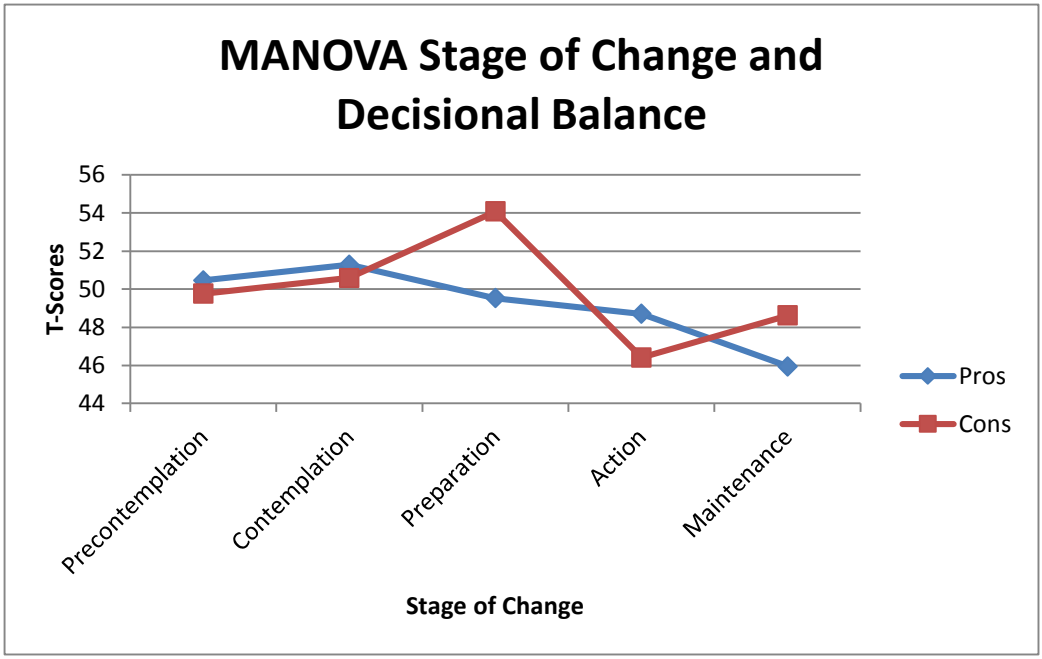

Figure 7. MANOVA T-score plot for Decisional Balance and Stage of Change (hypothesis two).

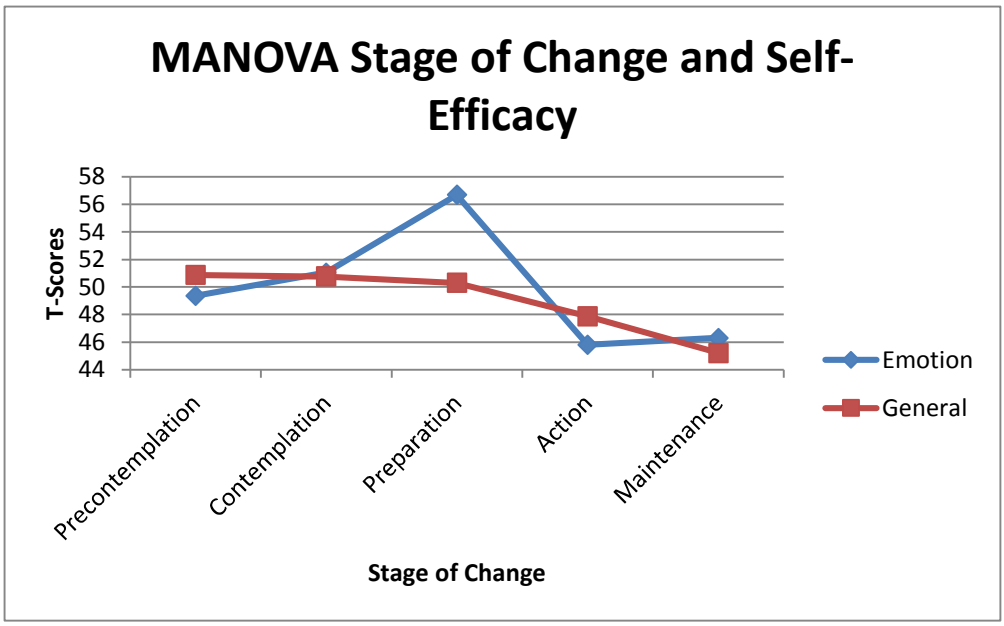

Figure 8. MANOVA T-score plot for Self-Efficacy and Stage of Change.

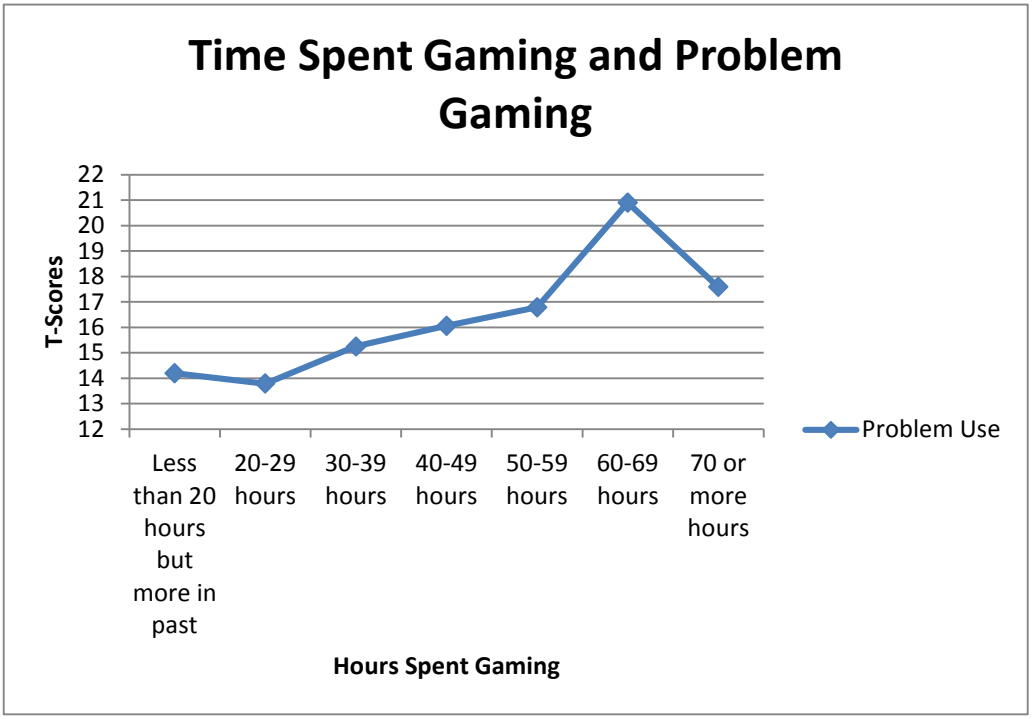

Figure 9. Means plot time spent gaming and problem gamer score (hypothesis one).

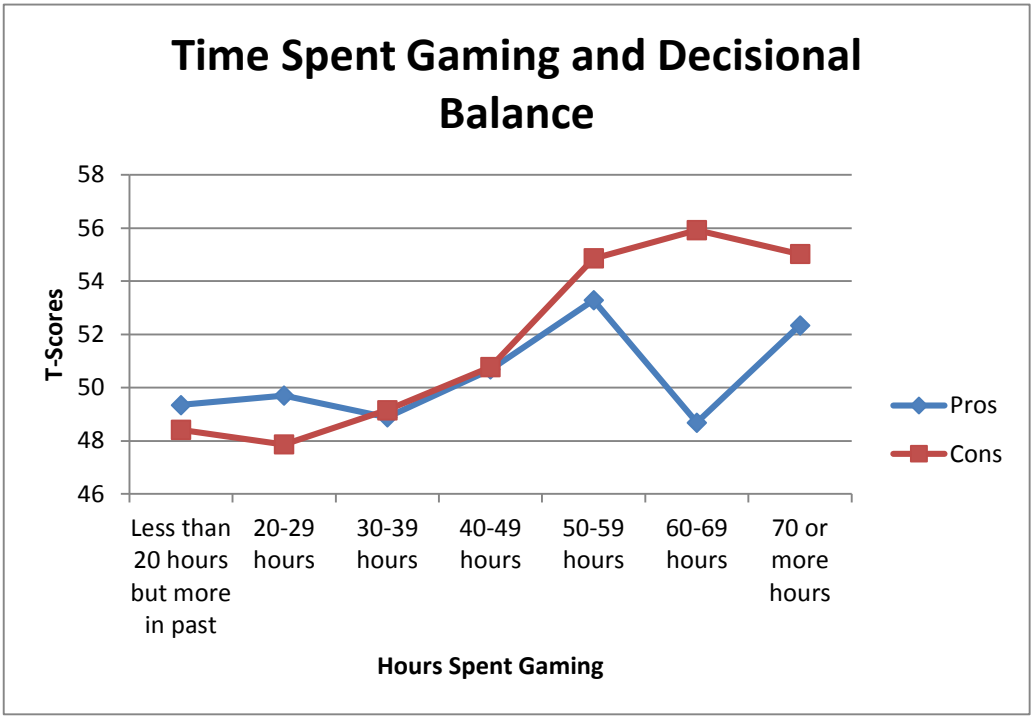

Figure 10. ANOVA Mean plot time spent gaming and DB Pros/Cons (hypothesis three).

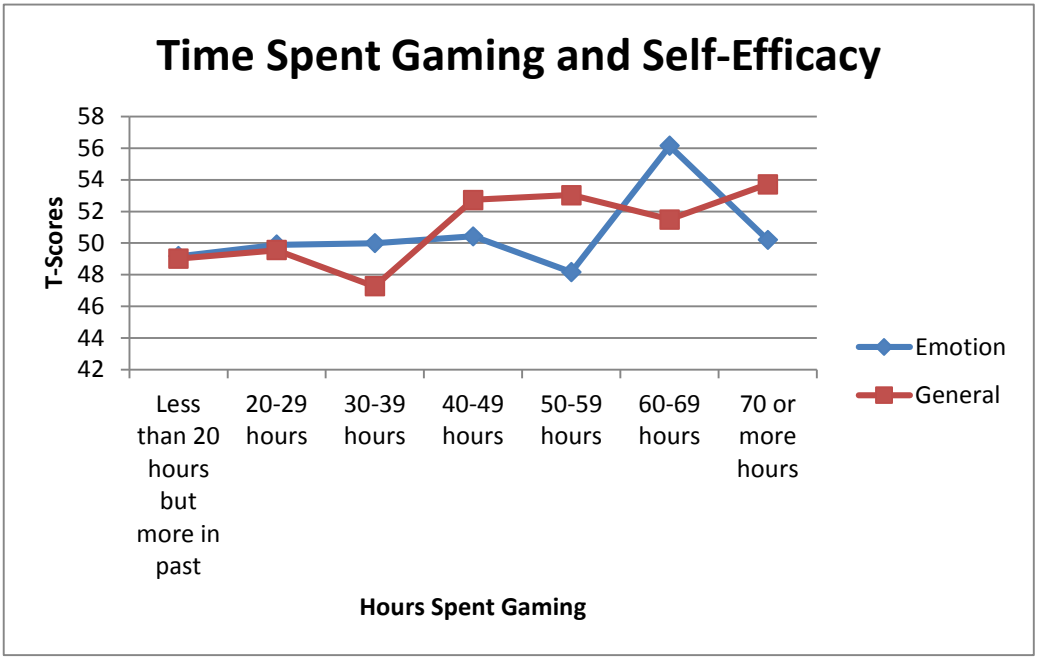

Figure 11. Mean plot time spent gaming and SE emotion/general.

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