Exploring the Relationships among Types of Video Games played and Self-Reported Critical Thinking and Problem-Solving with Undergraduate Students

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Abstract

Previous research has established that playing video games is related to many positive behavioural outcomes (Roy & Ferguson, 2016). However, not much is known about whether playing different types of video games has an effect on critical thinking and problem-solving skills. The purpose of this research was to explore the relationships among types of video games and self-reported critical thinking and problem-solving. Thirty-eight undergraduate students recruited through an online survey filled out measures on media use behaviour, extracurricular activities, critical thinking and problem-solving.

One-way ANOVAs indicated that there were no differences between types of video games played and critical thinking ($p = 0.055$) and the types of video games played and problem-solving, ($p = 0.081$). Spearman correlations yielded no significant results for the relationship between time spent playing video games and problem solving or between time spent playing video games and critical thinking. The results also showed that the relationship between the types of extracurricular activities and problem-solving skills was not statistically significant, ($p = 0.22$); nor was the relationship between types of extracurricular activities and critical thinking statistically significant ($p = 0.09$). In conclusion, there were no relationships between type of video game played and critical thinking and problem solving. Additional research in this area is needed to further investigate the relationships between types of video game play and problem solving and critical thinking. The current study had a very small sample of gamers (n = 27), resulting in low power and may be the reason for lack of significant findings. Future research should seek to obtain a more diverse sample in terms of age and gender as well to focus on recruiting a more representative sample of gamers.

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Chapter 1

Statement of the Research Problem

Young people are engaged in a variety of extracurricular activities, such as sports, performance and art groups, and academic clubs. Since the introduction of commercial video games in the 1970s, many young people spend a good proportion of their leisure time engaged in video game play. Initially, research studies focused on the negative outcomes of playing video games (ie., Breuer, Festl, & Quandt, 2014); however, researchers have begun to document the benefits of playing video games. A shift in researcher interest in the identification of the positive outcomes associated with video game play is now evident in the literature (ie., Adachi & Willoughby, 2013). For example, newer research includes a focus on the positive influences of gaming on cognitive processes, and the behavioural and educational benefits of video game play. However, one area of interest that has not been thoroughly investigated is the potential positive impact of video game play on critical thinking and problem-solving behaviour. Therefore, the current study explored the relationships among video game type and self-reported critical thinking and problem-solving for undergraduate students.

Purpose of the Study

Previous research suggested that playing video games can have many positive impacts on young people. Specifically, Bowers and Berland (2013) found that playing educational games, such as puzzle games, has the potential to increase students' engagement in learning activities, including concentration, interest, and enjoyment. Another study has found that playing video games can increase helping behavior, cooperation, sharing, and empathy (Prot, Gentile,

Anderson, Suzuki, Swing, & Lim, 2014). Further, Roy and Ferguson (2016) concluded that video game play, whether cooperative or competitive, can be an effective tool to reduce stress and shyness in players. Finally, playing video games can also lead to increases in perceptual ability, spatial skills, and enhanced mental rotation abilities (Eichenbaum, Bavelier, & Green, 2014). Although research has looked at the positive impacts of video game play, there is no research to date that has specifically investigated the effects of playing different types of video games on problem solving and critical thinking.

In an effort to extend previous research, this study examined the relationships among video game types and self-reported critical thinking and problem-solving. While some studies have investigated relationships between playing adventure video games and problem-solving skills (Adachi &Willoughby, 2013), other studies have looked at strategy video games and critical thinking (Gerber & Scott, 2011). Although many types of video games are played by young people, to date no study has explored the types of video game play with both critical thinking and problem solving as outcomes. Given the gap in the literature, I wanted to explore if the type of video game played has different effects on critical thinking and problem-solving in young people. Therefore, the purpose of this study was to survey undergraduate students about their video game play to determine if there were relationships among types of video game played and self-reported critical thinking and problem-solving.

Conceptual Framework

Videogames are powerful learning tools, as they create a unique environment for players to develop certain cognitive skills, including critical thinking and problem-solving skills (Gee, 2003; Gerber & Scott, 2011). According to Gee (2003), video games are designed with many problem-solving opportunities, where players can engage in immersive worlds and

stimulate their thinking. This study was inspired by Gee's (2003; 2005) learning principles that support thinking and problem solving.

These learning principles that are involved in video games are, first, well-ordered problems are presented in the video games; the problems that players face within the games are ordered so that earlier scenarios are well developed to lead the players to guess how to progress when they face harder problems later on in the game. Second, video games are pleasantly frustrating: challenge is the most important component in the game. During the game, players feel challenged, but they are highly motivated to continue playing as they feel it is possible to proceed and possible to finish. The third leaning principle is the cycle of expertise; games offer players a set of challenging problems and then let the players solve these problems. Games then expose players with more challenging problems, requiring them to rethink, learn new skills, and integrate new learning with old mastery. Fourth, just in time and on demand information is offered; games offer verbal information "just in time" when players need it, or "on demand" when players feel a need for it and request it in order to proceed.

The fifth learning principle is system thinking; games encourage players to think about relationships between events, facts, and skills. Thus, players need to think how the action taken might affect their future action and the actions of other players playing against them. The sixth learning principle is about thinking laterally, exploring, and rethinking goals. Games encourage players to explore carefully before they move on, to think creatively, and to use this exploration and careful thinking to perceive their goals. Finally, opportunities to advance skills as strategies are built into the game; through playing games, players have opportunities to practice skills and they can translate these skills into strategies to know the game.

Gee (2005) suggested that video games allow players to learn how to take risks and solve challenging problems, and that learning occurs from transformation in the learner triggered by the experience. Based on this framework, it is hypothesized that through video game play experience, players might also be encouraged to apply skills that they learned in games in real life problems. This perspective led to the current study's exploration of the relationships among video game type and critical thinking and problem-solving outside of game play.

Problem-solving and critical thinking skills are useful skills in everyday life. There are many important settings where these skills can be developed. Shute, Ventura, and Ke, (2015) argued that developing problem solving and critical thinking skills are the primary goal of schools; however, these skills may also be enhanced by video game play. Playing video games may be influenced by a variety of factors including the structural characteristics of video games. The characteristics refer to those features inherent within the video game itself that may facilitate initiation, development, motivation and maintenance of video game playing over time (Daniel, Delfabbro, & Griffiths, 2010). Research has shown that specific features of game play may be associated with enhancing critical thinking and problem-solving skills. Gee (2003) uses Complexity Theory to explain how video games were designed to encourage players to think critically about relationships between facts, skills, and events, thus enabling players to use actions and interactions, and develop complex understandings. Video games also enhance communication and constant interaction between players and the game in terms of solving many interesting, challenging, and difficult problems (Gee, 2003). In other words, playing video games may enable gamers to feel empowered to solve complicated problems allowing players to experience a depth of understanding of the problem, to learn to take risks, and to solve more challenging and complex problems.

Research suggests that video game play may be valuable for learning. For example, persistence in playing games can lead to an improvement in cognitive performance as well as the development of attentional and visual skills in players (Shute, Ventura, & Ke, 2015). According to Davis and Sumara (2006), playing games enables players to become: empowered learners, effective problem solvers, and successful gamers with an in depth understanding to engage in a complex world (as cited in Sanford & Hopper, 2009).

Critical Thinking. There are many different definitions of critical thinking skills, but all can be conceptualized as cognitive processes that are used to generate and evaluate information (Fanetti, 2012). According to Hummell (2016), critical thinking is an intellectual ability to interpret, analyze, and evaluate information and the ability to approach problems correctly that can be applied in a wide variety of situations. Fanetti (2012) also described critical thinking as reflective thinking that is focused on deciding what to believe or to do. The value of critical thinking skills is not just having information, but also being able to use it to influence cognitive process and behavior (Gerber & Scott, 2011). These cognitive processes entail analysis, interpretation, evaluation, self- regulation, and explanation. Consequently, when someone encounters a problem, their approach is to use reasoning consistent with internal motivation in order to engage in problem solving and to make decisions by thinking critically to solve it. Accordingly, this skill can be enhanced by playing video games. Playing some types of video games can help to improve strategic thinking. As well, playing video games might enhance cognitive flexibility allowing the individual the ability to adapt and switch between tasks and think about multiple ideas at a given time to solve problems (Gerber & Scott, 2011). Given the potential importance of video games in the development of critical thinking skills, it seems that more attention to the examination of the relationships between video game played and critical

thinking is warranted. Therefore, this study explored the relationships among different types of video game and self-reported problem solving and critical thinking.

Problem Solving. Although researchers have been studying problem solving for decades (Jonassen, 2003), the definition of problem solving tends to differ across studies. One definition of problem solving states that it is a higher-order cognitive process and intellectual function (Adachi & Willoughby, 2013). Jonassen (2003) highlighted that problem solving involves cognitive skills that are important in professional workplaces as well as in everyday life. Shute, Ventura, and Ke (2015) identify some characteristics of problem solving which include: "it is a cognitive process; it is goal directed; and the complexity (and hence difficulty) of the problem depends on one's current knowledge and skills" (p.13). Furthermore, the process of problem solving entails four aspects: Rule identification is the ability to acquire knowledge of the problem-solving environment. Rule application is the ability to control the environment by applying that knowledge or solving problems by using existing rules. Flexibility is using tools in more creative ways. Resource management is the ability to distribute resource more efficiently and effectively (Shute, Ventura, & Ke, 2015).

Shute and Wang (2015) argued that problem solving is not an innate skill, but rather it is a skill that can be developed when young people have ample opportunities to solve problems. Video game play creates an unique environment that can promote certain cognitive skills and flexibility through problems that encourage players to creatively find a solution to problems or rethink for alternative strategies by using available tools in games (Shute, Ventura, & Ke, 2015). This skill is fundamental because the way in which students learn how to solve problems and use different strategies might have an influence on their ability to understand a problem and solve it, as well as apply the same skills to the world around them. In other words, playing video games

may provide an appropriate environment for players to develop problem solving skills. Although there are studies that examined video games and problem-solving skills (Adachi & Willoughby, 2013), no research that has explored different types of video game play and problem-solving was found in the literature. Thus, the purpose of this study was determine if there are relationships between types of video game played and critical thinking and problem-solving.

Video Games and Game Type

What is a game? It is a type of play that takes place in a pretend reality, in which the participants follow a set of rules to achieve goals. Crawford (2003) defined a game as a form of play with goals and structure, and where players make decisions throughout the game in order to manage resources and achieve their goals (as cited in Aktaş & Orçun, 2016). According to Zimmerman (2004), a game   is "a voluntary interactive activity, in which one or more players follow rules that constrain their behavior, enacting an artificial conflict that ends in a quantifiable outcome" (p. 160). These definitions share some basic elements, such a competition, rules, goals, entertainment, interactions, and challenges (Gredler, 2004).

Video games are just one type of play or game available to young people. Video games meet the definition of games above and are also viewed as a form of play. Play can be defined as a free and voluntary activity in which the means (process) is more valued than goal or end points (Esposito, 2005). Another definition of play is that it is self-directed and self-chosen activity and play has structure and rules that comes from the mind of players (Zimmerman, 2004). Ashiabi (2007) explained that children learn through play: when children are engaged in play, they build and extend their skills and knowledge through interacting with others. However, as children learn from play, it was proposed that games might help to improve cognitive skills.

Young people are engaged in variety of extracurricular activities. Since the introduction of commercial video games, many young people spend their leisure time playing video games. There are many different types of video games that young people play; for example, sport, music, active, strategy games. Gerber and Scott (2011) offer a classification of genres of video games, and description of each genre and can be seen in Table 1.

Given the various types of video games that young people play, researchers to date have limited their focus to specific genres rather than the range of types of games available. Although Gerber and Scott (2011) have investigated the impacts of different game genres on critical thinking disposition, they found that playing strategy games might have an effect on critical thinking disposition, and they suggested further research to study theses genres was needed. Therefore, the areas of critical thinking and problem solving have been selected to expand on this early research. The present study aimed to explore the relationships among the types of video games played and self-reported critical thinking and problem-solving.

Table 1 Game Genres and Descriptions

Game Genre	Description
Action	An action video game emphasizes physical challenges that require players to use quick reflex and timing to overcome obstacles. There are many subgenres of action video games, including first-person shooter games and fighting games.
Adventure	Adventure games emphasize exploration and require players to solve different puzzles or tasks by interacting with different environments and characters to access to new places. An example of these games are real time 3D adventure and Graphic adventure.
Action adventure	Action adventure games combine two types of games, action and adventure games, and they emphasis exploration and combat, involving item gathering, simple puzzle solving, and combating for example, stealth games, survivor horror games, platform, and third-person shooter games.
Simulation	Simulation games require players to manipulate component of real and fiction system to achieve specific goals. For example, city construction and management simulation, building simulation, and business simulation.
Sport	Sport games some games emphasize playing sport such as car racing games, and other sport games emphasize strategy and organization such as team management.
Strategy	Strategy games require player to focus their attention and use plan and deep thinking to compete opponents for resource in order to success. For example, 4X game and wargames.

Note. Adapted from "Gamers and gaming context: Relationships to critical thinking" by Gerber and Scott, 2011.

Research Questions

1. Is there a relationship between type of video game play and

   a) Problem solving?

   b) Critical thinking?

2. Is there a relationship between time spent playing video games and

   a) Problem solving?

   b) Critical thinking?

3. Is there a relationships between types of extracurricular activities and

   a) Problem solving?

   b) Critical thinking**?**

A brief description of the study

This was a pilot study aimed to examine relationships among types of video game played and self-reported problem solving and critical thinking. An on-line survey design was developed and included a series of questions. Questions around participant demographic characteristics, experience with video games, critical thinking and problem-solving questions were derived from previous research and standard research measures. Following university research ethics board approval, permission from classroom faculty was received to recruit undergraduate students to complete the on-line survey. All data then entered into the Statistical Package for the Social Sciences (SPSS; version 24 for Macintosh; SPSS Inc., Chicago, Illinois, USA). For the analysis plan, one-way repeated measure ANOVAs were used to answer the first and third research questions; Spearman's correlations were applied to answer the second research question.

Thesis Organization

Chapter one provides the purpose of the research, conceptual framework, and the research questions. Chapter two introduces the relevant literature and research about the negative and the benefits of video game play. It also provides with relevant literature on problem solving, and critical thinking skills. Chapter three describes the research methodology, instruments, and data analysis. Chapter four presents the results and analysis of data collected from the study. Chapter five discusses the analysis and results of the study in reference to established research, in order to articulate the findings of the study and to draw relevant conclusions. Chapter six presents recommendations for future research, limitations, and the conclusion.

Chapter 2

"If you want to teach people a new way of thinking, don't bother

trying to teach them. Instead, give them a tool, the use of

which will lead to new kinds of thinking"

(R.Buckminster Fuller, n.d.)

Introduction

Video games have changed the way we view, think about, and participate in recreation, entertainment, and play. Video games encompass many aspects of social, economic, and cultural values, they have changed society's idea of gaming and play, evolving from the simple shapes of Pong to the massive multiplayer game of *World of Warcraft* (Bambach, 2014). It appears that this cultural phenomenon is a significant as any other media in their stage of development such as television, radio, and movies that have considerably changed the way people view the world and communicate with others. As these other media were previously viewed with skepticism for their negative impact on education and psychology, now we have since seen their acceptance in society. Video games, as any other media, can have a powerful and positive influence on young people's lives.

The Significance of Video Games

Computer games have significantly changed the way children and adolescents spend their free time. According to Statistics Canada (2015), the number of people playing video games has doubled, from 3% to 6% between 1998 and 2010. Additionally, the amount of time they spent

playing video games has also increased from 1 hour 48 minutes to 2 hours 20 minutes in the same period. More precisely, adolescents between the ages of 12 and 19 spend 10 hours per a week playing video games.

Additionally, a recent report from the Entertainment Software Association of Canada (ESAC, 2014) showed that Canada has the third largest video game development industry in the world, and what is even more surprising is that about 90% of Canadian children and adolescents are gamers. Since the video game industry has evolved, games have become increasingly accessible through mobile apps, phones and tablets, offering different platforms and themes, and a wide variety of genres and goals. These include strategic, sports, shooting, adventure, active, and racing games, and they can be played cooperatively, competitively, alone, and with other players one on one, or players online (Granic, Lobel, Engels, & Anderson, 2014).

With incredible development of the video game industry, the majority of young children and adolescents now engage in playing video games as a leisure activity (Brooks, Chester, Smeeton, & Spencer, 2016). In the study of *Video Gaming in Adolescents and Factors Associated with Leisure Time use* (2016), the research suggested that the number of hours that adolescents spend gaming has increased significantly in both genders from 42% to 55% for males and from 14% to 20% for females over a four-year period (Brooks, Chester, Smeeton, & Spencer, 2016). The report from the ESAC in (2014) showed that about 70% of adolescents' boys aged 13 to 17 years preferred to play computer and portable or console video games, while 42% of adolescents' girls preferred to play games via mobile devises. In terms of frequency of play, 54% of adolescents play video games every day, and another 35 % play video games about a few days a week. Similarly, in the same report, it has been found that in young adults (aged 18

to 34), 84% of the men and 69% of the women play video games. In terms of frequency of play, 45% of women and 49% of men play video games a few days a week.

Video Games and Extracurricular Activities

With the increasing number of children and adolescents playing video games, there are other leisure activities that adolescents involve in outside of the school time. Leisure activities have been defined as extracurricular activities or developmental activities that are practiced outside of school hours, including sports, performance and art clubs, and academic clubs (Wilson, Gottfredson, Cross, Rorie, & Connell, 2010). Some researchers suggested that participation in extracurricular activities are significantly associated with increasing interpersonal competence and school engagement in adolescents. In the study of *Youth Development in After School Leisure Activities* conducted by Wilson, Gottfredson, Cross, Rorie, and Connell (2010), the scholars explore different activities in which middle school aged youth typically engage. They found that there are a variety of activities that youth prefer to play, including sport activities such as basketball 43.6%, football 36.6%, and bike riding 20.1%, while 47.8% of youth prefer non-sport activities. A study of Canadian adolescents conducted by Forneris, Camiré, and Williamson (2015) explored the difference in school participation in extracurricular activities and developmental outcomes. The results showed that Canadian youth generally participated in a combination of sport and non-sport activities both of which led to an increased engagement in school.

Given the benefits of extracurricular activities in developing youth, it seems that video games can also contribute to positive youth development. Positive youth development is defined as process that build young people's assets and strengths through social, emotional, physical, and cognitive development (Bundick, 2011). Eccles, Barber, Stone, and Hunt (2003) argued that

organized activities are a good use of adolescents' time because such activities can provide many

opportunities to adolescents. This includes opportunities to acquire and practice specific skills

such as physical, social, and intellectual skills that are useful in school and community. Some

researchers indicated that organized activities such as sports and clubs can stimulate initiative in

adolescents because such activities promote three distinct elements: "intrinsic motivation,

concentration, and cognitive efforts, and cumulative over time to achieve a goal" (Adachi &

Willoughby, 2013, p. 156). More precise, when adolescents participate in sports, arts, clubs, and

hobbies, they report higher levels of both intrinsic motivation and concentration than when they

are in school (Adachi & Willoughby, 2013). Despite the fact that video games are not an

organized activity, they can, however, promote initiative in adolescents also fitting the three

distinct elements mentioned above. More precisely, it is clear that adolescents are playing video

games more than other organized activities due to the excitement and challenge content of video

games.

In addition, because of the complexity and challenge contents of video games, video

game play can also increase concentration and promote cognitive efforts. For example, when

video game players are involved in a game, they can be surrounded with difficult and

challenging environments and this promotes new skills, experience, and solutions to problems

that can be applied in real future challenges. Adachi and Willoughby (2013) claimed that video

games may also fit the third initiative component which is cumulative efforts to achieve a certain

goal. More precisely, in order for player to succeed or win the game, they have to create their

own strategy in each level of the game in time to get to next level. This, of course, may not only

encourage players to persist in playing games, but it can also offer them opportunities to learn

new skills, and these skills seem to be built upon cumulative efforts in each level to complete the

game. Therefore, video games, as any other organized activities, can stimulate initiative in adolescents. However, with growing numbers of young children and adolescents playing video games, it is also important to explore the outcomes associated with them.

Outcomes Associated with Video Game Use

Negative Outcomes of Playing Games

Since the earliest day of video games, many developmental and social psychological research has taken an interest on condemning games for their harmful influence on children and adolescents. A large number of research studies focused on the association between video game use and negative outcomes among children, adolescents, and adults, such as addiction and aggression (Milani, et al., 2013). For example, Anderson et al. (2010) found that exposure to video games is a risk factor for increased aggressive behavior and decreased empathy and pro-social behavior in adolescents. Similarly, a longitudinal research examined whether playing competitive video games such as sport and race, increases aggression in adolescents. They found that there was a positive association between non-violent video game play and aggression. More precisely, repeated exposure to competitive games may cause an increase in feelings of anger and hostility when players face a competitive situation, and persistent playing over time would lead players to behave aggressively (Adachi & Willoughby, 2013).

In line with previous research studies, Arriaga, et al. (2015) found that players who have more chronic exposure to video game play tend to have significant negative effects on their emotional desensitization. They also claimed the chronic experience with violence in games may reduce the gamer's emotional response toward real life situations that have similar content. In

addition, players who are desensitized to violence are more inclined to demonstrate aggression behaviour (Arriaga et al., 2015).

A further study examined the effects of the use of action and first-person shooter video games on three groups (adolescents 14–18), younger adults (19–39), and older adults (40+); differences were observed across the three age groups, finding an association between a preference for first person shooter games (FPS) and physical aggression that was strongest for the adolescents; however, there was no such relation for anger and verbal aggression (Breuer, Festl, & Quandt, 2014). Conversely, Brändle, Cardaba, and Rivera (2015) found that adolescents who were exposed to greater amounts of video game violence were more prone to engage in aggressive behaviors at school such as being involved in physical fights with other students. Other negative health outcomes of playing games may lead to young players becoming addicted to video game play (Brus, 2013). Also, another study found a negative association between video game use habits such as length of play and health exercise habits (frequency of exercise) and this was associated with higher Body Mass Index (BMI) in adult male players (Ballard, Melissa, Reilly, & Noggle, 2011).

The Benefits of Playing Video Games

As was mentioned earlier, there has been valuable research on the negative effects of playing games on children and adolescents' aggressive behaviour. However, in order to understand such an impact on children and adolescents' development, a balanced perspective is needed to understand the positive and the benefits of playing games.

Granic, Lobel, Engels, Anderson (2014) claim that "considering these potential benefits is important, in part, because the nature of these games has changed dramatically in the last

decade, becoming increasingly complex, diverse, realistic, and social in nature" (p. 66). A small number of studies now have begun to document these benefits. More importantly, it has been found that not only do video games provide adolescents with cognitive, educational, behavioural benefits, but they might also have the potential to benefit children and adolescents' mental health (Granic, Lobel, Engels, & Anderson, 2014).

Cognitive Benefits of Gaming. Playing video games might enhance the cognitive process and promote some cognitive skills, and this is especially true for action games (first hand shooter games). Recently, some training studies have investigated the relationships of playing action and non-action video games and potential cognitive skills such as a spatial memory, higher order control function, and visual process. For example, Oei and Patterson (2013) recruited 75 non -video game players and randomly assigned them to play five different types of games, including action, spatial memory, match-3, hidden- object, and simulation video games for the same period of time. They found that not only action games enhance cognitive benefits, but other types of games can also promote cognitive skills. Players in five games demonstrated higher visual search and spatial memory, and complex span.

It is so important to clarify that enhanced cognitive performance is not documented for all game genres, but it, in fact, comes from playing action games. For instance, playing action video games improves spatial attention skills for teens. More precisely, action games improved players' performance on the ability to locate a specific target quickly (Blumberg, Altschuler, Almonte, & Mileaf, 2013). Furthermore, action video games might also lead to increases in perceptual ability and higher visual processing, spatial skills, and enhanced mental rotation abilities (Eichenbaum, Bavelier, & Green, 2014).

Additionally, action games can improve memory (Clemenson, & Stark, 2015) and enhance executive function. (Gray, 2015; Fiske, Green, & Seitz, 2015; Kovess-Masfety, Keyes, Hamilton, Hanson, Bitfoi, Golitz, 2016; Lieury, Lorant, Trosseille, Champault, & Vourc'h, 2014). Executive function "refer[s] to the person's ability to allot his or her mental resources (such as perception, attention, memory) in ways that allow for rapid, efficient problem solving or decision-making" (Gray, 2015, para.10). For example, it has been suggested that playing action video games might improve the ability to engage in multiple tasks simultaneously (Chiappi & colleagues, 2013 as cited in Gray, 2015). As well, it may increase mental flexibility in which players' ability to switch rapidly between tasks is improved (Colzato, Den Wildenberg, & Hommel, 2014).

More surprisingly, playing an action game may not only increase the cognitive process of otherwise healthy players, but it can also enhance the cognitive function of people with impaired hearing (Nagendra, Kumar, & Mukherjee, 2017). Several studies have further shown that children with dyslexia and autism seem to benefit from training them on action video games. Franceschini et al. (2013) observed that greater video game use improved dyslexic children's scores on reading tests.

Finally, video games seem to be highly associated with another cognitive benefit which is enhanced creativity. A recent study has shown that playing games, regardless of game genre, might promote creativity. For example, Eichenbaum, Bavelier, and Green (2014) found a significant positive association between playing games and creative thinking in players.

Behavioural and Health Benefits of Gaming. Gaming can be an effective and efficient tool that can create positive behaviour for children and adolescents. Several studies have shown significant relationships between playing games and prosocial behaviour. In the study by Adachi

and Willoughby (2013), playing games "may not be related to social isolation or having fewer friends, but instead, may be an emotional substitute for real friendship that is used when adolescents are alone" (p. 159). Others have observed that playing video games was related to helping behavior, cooperation, sharing, and empathy (Prot, Gentile, Anderson, Suzuki, Swing, & Lim, 2014). According to Harrington and O'Connell (2016), a prosocial video game is a game that encourages players to cooperate with others in order to succeed. A recent study indicated a positive and significant association between video game use and cooperation, prosocial behaviour, and empathy in children and adolescents (Harrington & O'Connell, 2016).

Given these findings, it has been argued that violent video games may also contribute to a significant increase in cooperation and prosocial behaviour in adolescents (Jin & Li, 2017). Further research has also investigated the advantage of using video games on overcoming social difficulties. For example, Kowert, Domahidi, and Quandt (2014) found that playing online video games has the potential to be socially and emotionally advantageous to sensitive players, allowing them to overcome shyness and making new friends. Similarly, playing video games has been linked to decreased shyness in players. Video game play, whether cooperatively or competitively, can be an effective tool to reduce stress in players (Roy & Ferguson, 2016). Finally, games seem to be beneficial with adolescents with ASD autism spectrum disorder. Mazurek, Engelhardt, and Clark (2015) suggested that playing video games might help individuals with ASD, in terms of providing a relief from anxiety and stress.

Educational Benefits of Gaming. Video games have also made a significant positive impact in the field of education. Several scholars indicated that playing games has the potential to increase students' engagement in classrooms, and this in turn leads to increase their academic performance. Students 'engagement can be described as "Attending to lessons, participating in

class discussions, listening to instructors or classmates, taking part in tasks, and following the

rules are all regarded within the scope of engagement" (Çakıroğlu, Başıbüyük, Güler, Atabay, &

Yılmaz, 2017, p. 99). A true experimental study was designed to investigate the level of

engagement of adolescent students (18 to 24 years) and academic performance, before and after

treatment. The result indicated a positive correlation between students' engagement and

academic achievement with gamification dynamics. In other words, students who have higher

Gamification Evaluation Scores (GES) had higher Engagement Scale Scores (ESS). A further

study examined the association between academic achievement in high school students and video

gaming used in a large nationally representative sample (Bowers, & Berland, 2013). They found

that video game play has significant benefits for thinking and learning.

In particular, there were significantly positive associations between playing computer and

video games and increased reading and mathematics achievement assessments. That is to say,

using computers for fun and playing video gaming may provide an additional benefit to improve

student achievements in other school activities such as homework, extracurricular activities, and

recreational reading (reading outside of school) (Bowers, & Berland, 2013). A similar result was

found by Çakıroğlu, et.al. (2017) in the study of the influence of gamifying on engagement and

academic performance.

In line with this research, Hamari, Shernoff, Rowe, Coller, Asbell-Clarke, and Edwards

(2016) suggested that educational games such as puzzle games have the potential to engage

students in learning activities (concentration, interest, and enjoyment), and this level of

engagement might be activated by challenges during each level of play. Indeed, perceived

challenges of the game can have an effect on learning, that would increase engagement, and this

was a strong predictor of positive learning outcomes. This was also true for adolescent players.

Przybylski and Mishkin (2016) found that compared to adolescents who did not play games, adolescents who played one hour per day not only had active academic engagement, but they also had significant positive psychosocial function in classrooms. In addition to students' engagement level, scholars have also considered that serious video games are excellent and effective learning tools for developing and teaching intercultural communicative competence. For example, a sample of a hundred and six students were randomly assigned into groups to play a serious game called *It's a Deal*. The results indicated that this game may have the potential to develop and enhance the students' intercultural communicative competence which is due to its educational contents and clear pedagogic objectives (Guillén-Nieto, & Aleson-Carbonell, 2012). Video games seem to be associated with additional educational benefits as was found with undergraduate students in Japan Universities learning the English language (Bolliger, Mills, White, & Kohyama, 2015).

Researchers also highlight the additional benefits of gaming in promoting problem solving skills (Adachi & Willoughby, 2013). Games encourage players to stop and think critically before moving on to new strategies, explore different possibilities, consider new approaches and goals instead of simply progressing to finish the game as fast as possible. Therefore, problem-solving and critical thinking skills are so important; however, to date, research on the link between video game play and problem solving and critical thinking are limited. Because it is not clear whether playing video games can predict problem solving and critical thinking behaviour, or whether individuals who have these skills are more likely to play video games, this research is a first step by looking for potential relations among variables.

The Current Study

To search for relevant scholarly reports related to video games and critical thinking and problem solving, a literature review was completed using the following online databases: ProQuest Research, ERIC, Psych INFO, EBSCO, and Google Scholars. The keywords used were: "Video games", Video game play", "Benefits", "Advantages", "Positive", "Critical thinking", Problem solving", "Creativity", and "Cognitive development". The inclusion criteria required that articles be full-text editions, and peer-reviewed sources from the year 2011 onwards, relating to children and youth. Results provided 94 potentially relevant articles from the EBSCO group and 10 from the ProQuest group. An additional search as completed in Google Scholar generated 1,100 relevant articles, and first five pages were selected to include 147 relevant articles, and this compiled 251 articles. Duplicates were removed, title and abstracts were then reviewed, resulting in a total of 34 articles for general benefits of video gaming. The 34 articles were then assessed and only those whose titles and keywords that were related to the critical thinking, problem solving, creativity, and video games were included for a final number of 8 relevant citations. These 8 articles can be seen in Table 2.

Problem Solving and Video Game Play

Problem solving skills are crucial skills in education; students are not born with these skills, but they learn them by having an environment that is rich in opportunities to solve problems. However, to date, research exploring the benefits of playing games is limited. Only a relative handful of training studies have specifically examined the relationships between playing video games and problem-solving skills. Among these, the first and longitudinal quantitative research was conducted by Adachi and Willoughby (2013) to examine the relationships between playing strategic games and problem solving and academic grades. The scholars found positive

relationships between playing strategic video games and increasing problem solving skills. Specifically, they indicated that adolescents who played a strategic game for almost six years had higher problem-solving skills, compared to non-frequent video game players. The additional benefit of playing strategic games is that players might be able to utilize these skills in real life situations. Adachi and Willoughby also found a positive association between the use of problem-solving skills and increased academic grades for players.

Another training study that measured problem-solving skills concluded that playing adventure games could possibly increase problem solving abilities for adolescents (Hou & Li, 2014). More precisely, 67 university students were recruited to play an adventure game called *(Boom Room)* and this game was designed to promote learning through problem-solving process. The results showed that this game can be used as a valuable learning tool for students as it helped them to improve their learning performance. Furthermore, Shute, Ventura, and Ke (2015) concluded that problem solving skills improvements derived from playing first person shooter and puzzle games comparable to the effects of playing Lumosity games (a web-based platform that hosts more than 50 small-scale games) that aimed at improving these same skills. Further, this study showed that problem solving skills can be enhanced with video game plays in a brief period of time, and these benefits last for long time. In fact, these skills also benefit players outside the video game context.

Furthermore, some training studies have shown significant implications for education and personal development. For example, Hwang, Hung, and Chen (2014) outlined the power of video games in enhancing students' learning motivation, improving their deep thinking, and developing their creativity. Similar to this research, Kim, Chung, and Yu (2013) designed a program through computer games to encourage students to solve problems. The result indicated

that by the training program, students' logical and scientific thinking were enhanced significantly.

Yang (2012) looked at the use of digital game based learning (DGBL) as means of increasing students' motivation, problem solving, and academic achievement. Digital games based learning "are a popular strategy for engaging students by making learning fun" (p. 366). This game was designed to simulate different types of real life problems, enhancing students' ability to find causes and solutions for problems. Yang found that in the experimental group, students' problem-solving ability improved considerably after playing a designed game for specific period of time than in a control group. In addition to that, students learning motivation level also increased and this, in turn, leads to improve students' learning outcomes.

Critical Thinking and Video Game Play

Until recently, a small number of research studies have been conducted to explore the relationships between video games and critical thinking skills (Table 2). Two studies have explicitly tested this relationship; in both, critical thinking skills were defined as crucial skills that encourage and motivate individuals to engage in problem solving and make decisions by thinking critically to solve it. One study was a quantitative study, and conducted by Gerber and Scott (2011) to investigate the difference between video game players and non-players on critical thinking dispositions. As well, they examined relationship between critical thinking dispositions and game context. Among a sample of 121 adolescents aged between 18 to 22, video game playing was positively associated with critical thinking skills. However, this association was only found in strategy video game players. Specifically, strategy video game players have higher critical thinking skills than non-strategy gamers. The other study was conducted by Yang and Chang (2013) and showed that the more adolescents participated playing digital game, the more

improvement were evident in students' concentration and critical thinking skills.

Table 2

The summary of results in the literature on video games, problem solving and critical

thinking

Authors, country, year	Objective/focus	Population	Methodology	Key points
Adachi & Willoughby Canada, 2013	To examine whether strategic video game play can predict problem solving skills	High school students in grades 9, 10,11, and 12. N = (1,492 adolescents)	Scientific peer-reviewed journal: Journal of Youth and Adolescence. It is quantitative, and first longitudinal study that examined the link between video games and problem-solving skills.	The results showed that the more students strategic video game play predicted higher problem-solving skills over time than less strategic video game play.
Hou & Li, 2014, Taiwan	To evaluate multiple aspects of a problem-solving-based educational adventure game, *Boom Room* and the impact of this game on learning	Sixty-seven university students	Scientific peer-reviewed journal: Computers in Human Behavior. An empirical case study	The results indicated that this game is so beneficial for students with insufficient background knowledge of computer assembly, and also it can be used as a valuable learning tool for students as it helped them to improve their learning

Authors, country, year	Objective/focus	Population	Methodology	Key points
Shute, Ventura, & Ke, 2015 USA	The aim of this research is to examine the difference between playing portal 2 (first-person puzzle-platform video game) and Lumosity in enhancing cognitive and noncognitive skills in players.	77 undergraduate students. 18 to 22 years old	Scientific peer-reviewed journal: Journal of Computer and Education. Quantitative method: A true experimental study	Playing Portal 2 (first-person puzzle-platform video game) can have impacts on cognitive and noncognitive skills more than playing Lumosity
Hwang, Hung, and Chen, 2014, Taiwan	The goal of this research is to examine the effectiveness of Digital game-based learning in improving learning achievement of students and problem-solving skills.	Elementary school students, aged 12 years old. N=167	Scientific peer-reviewed journal: Educational Technology Research and Development. Quantitative method: quasi experimental study	The result showed that proposed approach effectively improved the students' learning achievements, motivations and problem-solving skills
Kim, Chung, and Yu, 2013 Korea	The purpose of this study is to propose a training program for creative problem solving based on computer programming	119 students 13–14 years old), and 30 students 12–13 years old	Scientific peer-reviewed journal: The Journal of Creative Behavior. Experimental study	The result indicated that by the training program, students' logical and scientific thinking were enhanced significantly.

Authors, country, year	Objective/focus	Population	Methodology	Key points
Yang, 2012	This study aimed to investigate the effectiveness digital game-based learning (DGBL) on students' problem solving, learning motivation, and academic achievement.	44 students 15–16 years old	Scientific peer-reviewed journal: The Journal of Computers & Education. A quasi-experimental design	DGBL was an effective learning tool that can be used in promoting students' problem-solving skills.
Yang and Chang, 2013	How can digital game help to empower and enhance concentration and engagement, foster higher order thinking, and improve learning outcomes.	seventh-grade, 13 to 14 years old students N = 67	Scientific peer-reviewed journal: The Journal of Computers & Education. An experimental study	Students critical thinking skills improved significantly this helped to improve their academic achievement.
Gerber and Scott, 2011, USA	To investigate the difference between video game players and non-players on critical thinking dispositions. As well, they examined relationship between critical thinking dispositions and game context.	121 adults' gamers and non - gamers	Scientific peer-reviewed journal: Journal of Educational Technology.	There was association between video games and critical thinking. This relation was only found in strategy video game players. Specifically, strategy video game players have higher critical thinking skills than non-strategy gamers.

Summary of the Literature

Based on the literature, it appeared that there are some research studies on problem-solving and critical thinking skills. However, one area of interest that had not yet been investigated is the question of the potential positive impact of the type of video game played with both critical thinking and problem-solving behaviour. Thus, the purpose of this study was to survey undergraduate students about their video game play to determine if there were relationships among types of video game played and self-reported critical thinking and problem-solving.

Chapter 3

Methods

This pilot study examining the relationships among types of video games played and self-reported problem solving and critical thinking. This study used an on-line survey design method. The survey consisted of 68 questions. Questions around participant demographic characteristics, experience with video games, critical thinking and problem-solving questions were derived from previous research and standard research measures. The link to the on-line survey was posted by the department of Child and Youth Study on a Facebook page accessible to undergraduate community.

Participants

Forty-two undergraduate students at Mount Saint Vincent University took part in the study. Only participants who completed the survey and were between ages of 18 and 25 years old were included. Two participants were excluded as one was 17 years of age and the other was 30 years of age. Two other files were excluded because the survey forms were empty. The final sample in this research was 38.

Procedure

Recruitment. Approval to conduct the study was obtained from the University Research Ethics Board (UREB) at Mount Saint Vincent University (MSVU). To gain entry into undergraduate classes, contact was made with professors both in-person and email communications to attend their classes and given access to participants. After receiving their permission, the researcher student attended the Business, Chemistry, Nutrition, and Child and Youth Study classes for 10 minutes. The purpose and an overview of the study was presented in

the class (Appendix 1). A postcard with the study details and the link to the survey was given to the

students to conduct the survey (Appendix 2). Participants were offered an opportunity to enter a

draw for a $25 Sobey's gift card.

Informed Consent. Students were informed that participation in this research was completely

voluntary and it entailed no risk to respondents. The content of the survey contained no sensitive

information and was not likely to result in any harm or discomfort to the students. The

participants could skip or decline to respond to any questions they were uncomfortable

answering. Students were ensured that their answers for any questions cannot be linked back to

them. All information was obtained in this study were kept strictly confidential. The survey was

numerically coded to ensure participants' confidentiality and anonymity.

 Measures

The independent measures in this study are Demographic Questionnaire (DG), General

Media Habits Questionnaire. The dependent measures are Need for Cognition (NFC), and

Problem-Solving Inventory (PSI) (Appendix 3). Permission to use theses scales were received

from the authors (Appendix 3).

Demographic Questionnaire (DQ). This questionnaire designed to collect basic

demographic information, including gender, age, academic performance, and general habits and

interests concerning media use (time spent playing video games, types of video games played).

General Media Habits Questionnaire (GMHQ; Gentile, Lynch, Linder, & Walsh,

2004). GMHQ is a self-report measure that was designed to ask participants about their habits

and interests in various forms of media (e.g., television, video games). This study only included

the following questions in the analyses: (a) amount of time spent playing video games on a

typical day of the week, and (b) participant preferences for particular genres of video games. As

well, seven items were used to assess the amount of time participants spends playing video

games on a weekday (Monday through Friday) and a weekend (Saturday or Sunday). In these

items, participants were asked to specify how many hours they play video games. Also, there

were two questions related to extracurricular activities "What types of extra-curricular activities

do you participate in regularly", and "How many hours do you spend in extracurricular activity".

      Critical Thinking Measures: Need for Cognition (NFC). This self-reported measure is

developed by Cacioppo and Petty (1982), to measure individuals' tendencies to pursue the

process of thinking. This questionnaire has18 items that require individuals to rate and describe

the extent to which they agree with each statement using a 9-point scale from -4 ("very strongly

disagree") to +4 ("very strongly agree"), with 0 being "neither agree nor disagree". Example

items include "I prefer complex to simple problems", "I like to have the responsibility of

handling a situation that requires a lot of thinking", and "I try to anticipate and avoid situations

where there is a likely chance I will have to think in depth about something". Half of the items

were reverse coded. The final score for each participant is a total of the participants' points from

each of the 18 questions, such that the highest possible score is 72, and the lowest possible score

is -72.

      Internal consistency has been demonstrated with Cronbach's alpha 0.90 (Cacioppo &

Petty, 1982; Stenlund & Jonsson, 2017). The NFC is the most frequently used measures of

critical thinking disposition (Gerber & Scott, 2011; Osberg, 1987; Preckel, 2014; Stenlund &

Jonsson, 2017). Permission to use this measure was received from Dr. Petty. Previous literature

reported NFC to be valid and reliable based on their use of the scale (Cacioppo &Petty, 1982;

Preckel, 2014; Stenlund, & Jonsson, 2017). This measure was selected to remain consistent with

previous literature on video games and critical thinking (Gerber & Scott, 2011). Another

research study has indicated that undergraduates have a mean NFC score around 15 (Coutinho, Wiemer-Hastings, Skowronski, & Britt, 2005), which is consistent with the average in the present study ($M = 12.91$).

Problem Solving Inventory (PSI). This self-reported measure developed by Heppner and Petersen (1980). The PSI has 6-point Likert format with 35 items that measures the individual's perceptions regarding one's problem-solving abilities and problem-solving style in the everyday life, including behaviors and attitudes associated with problem-solving styles. Permission to use this measure was received from Dr. Heppner and Petersen. The PSI consists of three separate subscales. Problem-Solving Confidence (11 items) assesses self-perceived confidence, belief and self-assurance in effectively solving problems. Personal Control (5 items) assesses elements of self-control on emotions and behavior. Approach-Avoidance Style (16 items) assesses whether individuals tend to approach or avoid problems. Examples of items presented on the PSI include: "When I am confronted with a complex problem, I do not bother to develop a strategy to collect information, so I can define exactly what the problem is". "After I have solved a problem, I do not analyze what went right or what went wrong". "When I have a problem, I think up as many possible ways to handle it as I can until I can't come up with any more ideas".

This measure has 35 questions with 6-point Likert scale, ranging from '1' strongly agree to '6' strongly disagree. Out of 35 statements, 15 are reverse coded, and the final score for each participant is a total of the participants' points from each of the 35 questions, such that possible score range from 35 to 210. The PSI has been used in many research studies and has been referred to as one of the most widely used scales to assess one's perceived ability problem-solving behaviour (Heppner, Witty, & Dixon, 2004; Heppner & Baker 1997; Note, Puncky,

Ginevra, Ferrari, Soresi & Gibsons, 2013, Paul & Chris, 1982). The PSI has demonstrated high

reliability and validity in multiple studies over the decades since its initial publication (Heppner,

Witty, & Dixon, 2004; Kourmousi, Xythali, Theologitou, & Koutras, 2016; Note, Puncky,

Ginevra, Ferrari, Soresi & Gibsons, 2013; Heppner & Baker 1997; Soliman, & Gibbons, 2014).

The PSI has demonstrated acceptable internal consistency among different samples (e.g.,

substance abusers, college students) and cultural groups (Pretorius, Wei, Lee, & Wang, 2002).

The scale has also been shown to demonstrate good test-retest reliability. Internal reliabilities are

as follows: problem-solving confidence, $\alpha = .85$; approach-avoidance style, $\alpha = .84$; personal

control, $\alpha = .72$; and total inventory $\alpha = .90$ (Heppner & Petersen, 1980; Heppner, Witty, &

Dixon, 2004; Huang, Yu-Ping, & Flores, 2011). Previous research indicates that young adults

have a mean PSI score in the low 70s to low 80s, which remains largely unchanged throughout

undergraduate education unless the individual participates in a problem-solving training program

(Baumberger-Henry, 2005; Heppner, 1988). The average score in the present study is 83.02,

which is consistent with what has been established by previous research (Baumberger, Henry,

2005).

Statistical Analysis

Demographic data were presented, then t tests were conducted to compare gamers and

non-gamers on critical thinking and problem-solving. To examine the first research question, two

one-way ANOVAs were conducted (one for each dependent variable) by video game type. To

group the video game type variable, participants were asked to write the name of their favourite

video game. The researcher then grouped the open-ended responses in the categories of sport

video games, adventure video games, racing video games, action video games, action adventure

video games, puzzle video games, and simulation video games based on descriptions from the

game creators. Because of the fact that there was small number of participants in puzzle, simulation, and racing video games, the researcher then grouped these video games into three types of video games: action, adventure, and sport video games. Racing and simulation video games are considered to be a subcategory of sport games. Puzzle video games are a subcategory of adventure games, and action adventure falls under action video games. Therefore, the type of video game variable resulted in three types of video games: action, adventure, and sport video games. To conduct the ANOVAs, the type of video game variable was entered into the model as a between-group, independent variable, and critical thinking and problem-solving scores were entered as dependant variables (separately for each ANOVA).

The statistical significance was set at $p < 0.05$. Spearman's correlations were completed to determine the relationships between time spent playing video games and problem solving and critical thinking. Finally, two separate one-way ANOVAs were used to test the relationships between the type of extracurricular activities and critical thinking and problem-solving. For the type of extracurricular activities variable, participants were asked to select the extracurricular activities they participated in from a list of potential activities, including team sport, music, drama, individual sport, clubs, and religious activities. There were no participants who selected religious and drama activities. As there were small number of participants in clubs and music, the researcher then grouped these two activities into social activities, while team sport and individual sport were grouped into sport activities. Thus the extracurricular activities variable resulted in two groups: sport activities and social activities. All data entered into the Statistical Package for the Social Sciences (SPSS; version 24 for Macintosh; SPSS Inc., Chicago, Illinois, USA).

Chapter 4

Results

The purpose of this research study was to survey undergraduate students about their video game play to determine if there are relationships among types of video game played and critical thinking and problem-solving skills. The results are presented in six sections: demographic data, descriptive analysis of CT and PS, *t*-tests of gamers and non-gamers on CT and PS, one-way ANOVAs by game type, Spearman's correlations, and one-way ANOVAs by extracurricular activity.

Demographic Data

Forty-two undergraduate students at Mount Saint Vincent University took part in the study. Only participants who completed the survey and were between ages of 18 and 25 years old were included. Two participants were excluded as one was 17 years of age and the other was 30 years of age. A further two cases were excluded because the survey forms were empty. The final sample entered into these analyses was 38 participants: 27 (71 %) gamers and 11 (29%) non-gamers. Table 3 shows that the majority of the participants (47%) were students enrolled in the Child and Youth Study program (n=18).

The mean age was 21.37 years (SD 2.19), with 27 gamer participants; 11 identifying as female, 15 male, and 1 other. There were more males who participated in the gamer group (n = 15, 55.6 %) than females (n = 11, 40.7%) other (n = 1, 3.7%). The non-gamer group consisted entirely of females (n = 11).

Almost one third (n = 11) of the participants (28%) reported that they never play video games. However, the majority (n =14) of the participants reported that they play video games once a week (35%), 6 (15%) reported that they play between 4 to 5 times a week, 3 (7.5%) play 2 to 3 times a week, and 4 (10%) reported that they play video games almost every day. Of the participants who play video games (n = 27), 1 (3.70%) reported that they have played video games for less than 1 year, 11 (40.7%) reported they have played video games for 2 to 5 years, and 3 (11.11%) have played video games for 6 to 10 years. However, the majority of gamers reported they have played video games more than 10 years (n = 12, 44.4%). Table 4 presents the amount of time participants spent playing video games in one sitting.

Participants were asked to write the name of their first, second, and third favourite video games; the majority of gamers (27) only provided a response indicating their first choice and many left the second and third choice responses blank. Therefore, the results for the first favourite game are presented. The researcher grouped the open-ended responses into six categories based on game descriptions and video game genre definitions: sport, adventure, racing, action, action adventure, puzzle, and simulation. These video game categories were then grouped into three types of video games due to small sample size: racing and simulation video games were grouped into sport games; puzzle video games were grouped into adventure games; and action adventure grouped into action video games. Table 5 presents the type of video game played by gender.

Participants were asked to select the extracurricular activities they participated in from a list of potential activities. Due to small sample size, these activities then were grouped into two categories: sport activities and social activities. The number of participants in sport activities

were 13 (34%) and 20 (52 %) in social activities. Five participants (14 %) did not provide their

response.

Descriptive Analysis of Critical Thinking and Problem-solving

Descriptive analysis of the problem-solving, and critical thinking are presented in Table

6. The mean score for problem-solving as measured by the Problem Solving Inventory was ($M =$

83.02, SD = 13.03), and the mean score for critical thinking as measured by the Need for

Cognition Scale was $(M = 12.91$, SD = 16.53). The mean scores across video game groups and

critical thinking and video game groups and problem-solving are presented in Table 7 and 8.

Critical Thinking and Problem Solving in Gamers and Non-Gamers

Separate independent group t-tests were used to compare gamers and non-gamers on

critical thinking scores and problem solving scores. The results indicate that there were no

significant differences between gamers and non-gamers on critical thinking score, t (31) = -

0.874, $p = 0.38$. Similarly, there were no significant differences between gamers and non-gamers

on problem-solving score, t (35) = 1.156, $p = 0$ .22. The effect size was small for both critical

thinking ($d = 0.31$) and problem-solving ($d = 0.40$). The mean scores for both groups (gamers

and non-gamers) on critical thinking and problem-solving are presented in Table 9. The results

of these t-tests are presented in Table 10.

**The Relationships Between the Type of Video Games and Critical Thinking and Problem-
solving**

Two separate one-way ANOVAs were conducted to test the relationships between the

type of video game played and critical thinking, and the type of video games and problem-

solving. The three subject groups were compared on the NFC and the PSI scores. The results

indicated that there was no significant differences between the type of video game played and critical thinking, $F (2, 24) = 3.819, p = 0.055$. Similarly, the result of the relationship between type of video games and problem-solving was not statistically significant, $F (2, 26) = 2.793, p = 0.081$. The results of these ANOVA analysis are presented in Table 11.

The Relationships Between the Time Spend Playing Video Games and Critical Thinking Scores and Problem-Solving Scores

Spearman's correlation analyses between time spent playing video games at one sitting and critical thinking (NFC) score and time spent playing video game at one sitting and problem-solving (PSI) scores are presented in Table 12. The result indicated that problem solving was negatively, but not significantly, correlated with critical thinking, $r (26) = -.341, p = 0.06$. The correlation between the relationships between time of playing video games and problem-solving scores was not statistically significant, $r (26) = -.287, p = 0.14$. Similarly, the correlation for the relationships between time spent playing video game and the scores on critical thinking was not significant, $r (26) = .227, p = 0.28$.

The Relationships Between the Extracurricular Activities and Critical Thinking and Problem-Solving

Two separate one-way ANOVAs were conducted to test the relationship between the type of extracurricular activities (sport and social activities) and both problem solving and critical thinking. No differences were found between the type of extracurricular activity and critical thinking, $F (1, 27) = 3.10, p = 0.09$. Similarly, there were no differences between the type of extracurricular activity and problem solving scores, $F (1, 31) = 1.52, p = 0.22$. Overall, results showed that there is no relation between the type of extracurricular activities and critical

thinking and problem-solving. Table 13 presents the results of ANOVA analysis of the type of

extracurricular activities and problem solving and critical thinking.

Table 3

Frequencies of Participants' Program Of Study

Programs	Gender			Total	Percentage
	Male	Female	Other		
Child and Youth Study	3	15		18	47%
Business	7	5	1	13	34%
Family Studies	0	3		3	8%
Psychology	0	4		4	11%

Table 4

Descriptive statistics of the Amount of Time spent playing Video Games at One Sitting

Answer choices	Total	Percentage
10-15 minutes	5	19%
15-30 minutes	2	7%
30-40 minutes	9	33.3%
One hour	11	40.7%

Table 5

Type of Video Game Frequency by Gender

Type of VG	Gender			Total	Percentage
	Male	Female	Other		
Sports	3	4		7	26%
Adventure	6		1	7	26%
Action	6	7		13	48%

Table 6

Descriptive Statistics for Dependent Variables

Source	n	M	SD	Minimum	Maximum
Problem-solving	38	83.02	13.03	57	105
Critical thinking	35	12.91	16.53	-23	60

Table 7

The Mean Scores of Critical Thinking Across Video Game Group

	N	*M*	*SD*	Minimum	Maximum
Action	11	17.09	16.14	-9	44
Adventure	7	10.14	13.08	-8	30
Sport	7	14.33	20.31	-23	35

Table 8

The Mean Scores of Problem-Solving Across Video Game Group

	N	*M*	*SD*	Minimum	Maximum
Action	13	78.69	11.89	97.00	108.00
Adventure	7	89.28	9.23	78.00	105.00
Sport	7	89.0	12.60	70.00	104.00

Table 9

The Mean Scores of Non-Gamers and Gamers on Critical Thinking and Problem Solving

	Non-gamers			Gamers		
	N	M	SD	N	M	SD
Critical thinking	11	9.20	17.28	25	14.70	16.30
Problem-solving	11	88.90	12.74	27	83.73	12.32

Table 10

Independent t tests of Gamers and Non Gamers on Critical Thinking and Problem Solving

	t	df	P	Mean difference	95% Confidence Interval of the Difference	
					Lower	Upper
Critical thinking	-.874	31	0.38	-5.496	-18.31	7.32
Problem-solving	1.156	35	0.22	5.17	-3.91	14.26

Table 11

ANOVA Analysis of Variance Critical Thinking and Problem Solving

Source	df_b	df_w	F	P
Critical thinking	2	24	3.819	0.055
Problem-solving	2	26	2.793	0.081

Table 12

Spearman Correlations between Time Playing VG and Critical Thinking and Problem Solving

	Time playing VG	Problem solving	Critical thinking
Time playing VG	1	-.287	.227
Problem solving		1	-.341*
Critical thinking			1

Note. VG =Video Games

* Correlation was not significant, but represented a non-significant trend *p* = .06 level

Table 13

ANOVA Analysis of Variance Extracurricular Activity

Source	df_b	df_w	F	P
Critical thinking	1	27	3.10	0.09
Problem solving	1	31	1.52	0.22

Note, significant at $p < 0.05$

Chapter 5

Discussion

The purpose of this study was to examine the relationships between playing different types of video games and critical thinking and problem solving. Researchers recently have demonstrated that playing video games can lead to increases in perceptual ability, spatial skills, and enhanced mental rotation abilities (Eichenbaum, Bavelier, & Green, 2014). Some studies indicated that playing video games can enhance cognitive flexibility in players giving them the ability to adapt and switch between tasks and think about multiple ideas at a given time to solve problems (Adachi & Willoughby, 2013; Basak et al. 2008). Roy and Ferguson (2016) indicated that video game play, whether cooperative or competitive, can be an effective tool to reduce stress and shyness in players. However, given these benefits of playing video games no studies to my knowledge exist in which researchers have examined the relationship between playing different types of video games on both critical thinking and problem-solving. Gerber & Scott (2011) investigated the difference between video game players and non-players on critical thinking dispositions. As well, they examined relationships between critical thinking dispositions and game context. They studied 121 adults between the ages of 18 to 22. They use Actively-Open Minded Thinking (AOT) and Need For Cognition (NFC) scales to measure dispositions towards critical thinking. The difference between Gerber and Scott (2011) and the present study is that Gerber and Scott examined game types individually, but did not compare across game types, which is the aim of the present study. Thus, the current study expands on Gerber and Scott's study (2011) and aimed to assess if there are relationships between types of video game played with both problem solving and critical thinking. Three research questions explored in the study are discussed in the context of the existing literature.

Analysis of Critical Thinking and Problem Solving in Gamers and Non-Gamers

Independent group t-tests indicated no differences between gamers and non-gamers on critical thinking or problem solving scores. This finding is different from other research on gaming and cognition that indicates that gaming has a positive effect on certain aspects of cognition (Oei & Patterson, 2013). It is possible that critical thinking and problem solving are aspects of cognition that are not influenced by game play; however, it is also possible that the current study found no effects due to sampling error and small sample size. However, this finding is consistent with Gerber & Scott (2011), who found that gamers and non-gamers did not differ on critical thinking (problem solving was not examined in Gerber and Scott's study). The current project extends these previous findings to problem solving. Furthermore, the current study expands on Gerber & Scott's (2011) results by examining critical thinking and problem solving by game type.

The Relationships Between the Type of Video Games and Critical Thinking and Problem-solving

The current study found no relationships between the types of video game played with critical thinking. This means that no support was found for a relationship between types of video game played and critical thinking. This may be due to low power in the study: only 27 participants were included in the one-way ANOVA, meaning that the effect of video game genre on critical thinking would have to have been large to be detected by the test. Perhaps the effect was too small to be found with such a small sample size.

The findings of the present study are not consistent with previous research on video game genres and critical thinking. Gerber & Scott (2011) found that people who play strategy

video games have higher critical thinking scores than people who do not play strategy video

games. There are key differences between Gerber & Scott (2011) and the present study: namely,

differences in measurement of video game type and differences in analysis. Gerber & Scott

(2011) asked participants which types of video games they played, and asked them to select all

that applied from a predetermined list. The present study asked participants to list their favorite

games, and the researcher categorized the games based on game descriptions. The present study

did not utilize the same categorizations of video game type as Gerber & Scott (2011) due to

small sample size. In the present study, each participant had only one game type, while Gerber

& Scott had multiple game types for each participant. In terms of analysis, the present study

compares critical thinking and problem solving across game types (i.e., using a one-way

ANOVA by game type), yet Gerber & Scott (2011) use a series of t-tests to compare individuals

who play and do not play a single type of game. Gerber and Scott is the only study that has

examined the relationship between critical thinking and video games.

The relationship between types of video games and problem-solving was not significant.

This means no support was found for a relationship between type of video game played and

problem-solving behaviour. Again, the low power in the current pilot study may have affected

these results. Another possible explanation for this result may stem from the measure of

problem-solving used in the current study. The study's scales were self-report questionnaires

that obtained participants' reflection to the questions rather than measuring these skills

objectively. The measure of problem solving might be vulnerable to social desirability bias.

Critical thinking and problem solving are seen as positive qualities indicating competence more

often than not. Since individuals typically perceive themselves to be competent individuals with

good qualities, they may rate themselves higher on these constructs than what an objective test

would indicate. While subjective measures are important, as they indicate how a participant views themselves, objective measures provide greater insight into the quality itself, rather than the participant's view of that quality. I chose to use a subjective measure because objective measures of critical thinking and problem solving may have posed a challenge to recruitment, as participants may be reluctant to complete a test due to testing anxiety or test duration. Future research should utilize both objective and self-report measures to assess problem solving.

This result of the relationships between types of video games and problem-solving is not consistent with previous research findings (Adachi & Willoughby, 2013; Hou and Li, 2014; Hwang, Hung, and Chen, 2014). Previous research had differing methodologies, study designs, and sampling populations (i.e., elementary school, high school, and undergraduate students). Thus, comparison of findings from the current study with other studies was difficult. For example, the research conducted by Adachi and Willoughby (2013) was a longitudinal study that examined only one genre (strategy video games) along with problem solving skills. Their sample consisted of 1492 adolescents between 11 to 14 years old. They found that, over time, adolescents who frequently played strategic video games had higher problem-solving skills than those who were not frequent players. Similarly, Hwang, Hung, and Chen (2014) studied 167 school aged children to examine the effectiveness of playing digital games on improving problem-solving skills. They found that playing digital games lead to increased problem-solving skills.

The current study, in contrast, examined a small sample of university age students. Due to the diversity and difference in these studies, both in the age of the participants and in the study design, it is difficult to compare across studies. However, due to the lack of research in

the area of video games participation on problem solving and critical thinking in general, there are few alternatives for comparison similar to the current study.

It should also be highlighted that because of the small number of video game players in the current pilot study, it was difficult to achieve statistically significant findings. With only 27 gamers included in the one-way ANOVA, effect sizes would have to have been large to be detected by the test (Steel & Torrie, 1980). It is possible that more significant findings would have been discovered if the sample had been larger. Future research should develop recruitment strategies aimed to increase the participation rates and subsequently enhance generalizability of the results and detect smaller effects.

The Relationships Between the Time Spent Playing Video Games and Problem-Solving and Critical Thinking

Correlations between time playing different types of video games with problem solving and critical thinking skills were not significant. No significant correlation was noted between problem solving skills and critical thinking ability, suggesting that these two variables are examining different constructions. The low power in the current pilot study may have affected these results. Moreover, some participants did not record their hours of play. Therefore, with a limited number of participants and missing data, further research is needed to better understand the relationship between frequency of gaming and cognitive skills in young adults.

This contradicts the finding of Gerber and Scott (2011) regarding to the relationships between gamers and game contexts and critical thinking disposition. Gerber and Scott (2011) found that adolescents that play more than two hours of video games each day have

significantly lower critical thinking skills than adolescents who play video games for less than two hours each day.

Similar to the findings of Gerber and Scott (2011), Hamlen (2013) found that greater time spent playing video games was related to less creativity and less flexible methods of thinking and problem solving in elementary school students. These results suggested that video game players who spend more time playing video games tend to be less flexible in thinking and problem-solving methods. Moreover, since gamers are highly familiar with the video gaming world, they become adept at solving problems using the same methods for other video games, so they do not engage in extreme creative thinking in solving different problems. However, it should be noted that these results do not suggest that video games are making adolescents less creative, but it is possible that the creative adolescents simply less attracted to play video games.

The Relationships Between the Extracurricular Activities and Problem-Solving and Critical Thinking

The analyses of the relationships between types of extracurricular activities with critical thinking and problem-solving skills were not significant. Although data analysis showed no significant results, there are many significant benefits of extracurricular activities in youth development. Wilson et.al (2010) indicated that participation in extracurricular activities are significantly associated with increasing interpersonal competence and school engagement in adolescents. Adachi & Willoughby (2013) also indicated that extracurricular activities can promote three distinct elements, including intrinsic motivation, concentration, and cognitive efforts, and cumulative over time to achieve a goal. In the present study, extracurricular

activities were combined based on similarity because of small sample size. Again, larger

sample sizes may lead to significant findings; further research is required.

Chapter 6

Study Limitations and Future Considerations

Although the current study is the first to investigate the relationship between type of video game played with both critical thinking and problem-solving skills, there are a number of limitations that must be considered. It is essential to highlight that the results of this study do not suggest that all video game players are more creative and critical thinkers than non-video game players, or that video game players have less problem-solving skills. In fact, it should be argued that it is unfair to investigate all types of video games as a general measure, without considering specific video games that may offer more creative skills than other games. Therefore, it would be beneficial to explore this further, and look at each type of video game individually.

One major limitation is that the sample for the study was drawn from an undergraduate student population, which may limit the generalizability of the results to gamers at large considering the growing diversity of gamers in terms of age and gender. In addition to that, the sample size was very small, with only 38 participants in general. As such, this study can only provide the reader with a 'snapshot' overview. In terms of age, the average participant was approximately 21-years-old and participants under the age of 18 were excluded from the study. This limitation in terms of age of the participants may limit the generalizability of these results to gamer populations at large.

Furthermore, the gender of participants may have influenced the results. In current study there were more female participants who were less interested in playing video games. This might be because of the fact that males tend to spent more time to play video games than

females. As well, game play might be more popular among males than females. The context of

the game might be another reason. That is to say, physical context in which games are played is

often a male dominated one, excluding females and game contexts might attract more males

than females because of the rules and structure of those games. These factors may reduce

females' motivational strength to play video games (Adachi & Willoughby, 2013).

Another potential limitation of the study may lie in the nature of how preference for

video game type and time spent playing games were classified. In the current study, participants

were asked to provide the names of their three most favorite video games. This information

was classified according to genre, and used to code participants into the gaming preference

group. However, most of the participants did provide their first favorite video games, but many

did not list their second and third favorite video games and hours of play video games. This

may be insufficiently specific in terms of how much information it can provide regarding how

the participant spends the majority of their time playing video games.

Another important limitation stems from the exploratory nature of this study. Since this

project was a pilot study with a very small sample size, it was extremely unlikely there would

be any statistically significant findings. Also, the study design does not permit causal

inferences. It might be, for instance, that video game players are naturally critical thinkers and

problem solvers. Further, the recruitment method and online survey format may have

influenced results. Finally, it is essential to remember that the study's scales, problem-solving

and critical thinking, were self-reported questionnaires that based on participants' reflection to

the questions rather than measuring actual critical thinking and problem-solving skills. These

limitations can be used to inform the design of future research in this area. Despite these

limitations, there are still many strengths. The study was based on solid research design which

can be replicated. Furthermore, it provided a foundation to demonstrate the positive impact in playing different types of video games on critical thinking skills.

Future Research

Future research should strive to continue to investigate the relationships between types of video game play and problem solving and critical thinking skills. The current study is an initial exploratory examination of the possible relationships of video games and cognitive skills, and future research may benefit by addressing the limitations noted above to further refine the results of this study. Future research should also seek to obtain a more diverse sample in terms of age and gender.

 It would be useful for future research to focus on recruiting a more representative sample of video game players. It will be also more interesting for future research to look at one type of video game and its effect on both critical thinking and problem-solving skills. Finally, future research studies can examine the long-term effects of playing video games on critical thinking and problem-solving skills, in both causal-comparative and experimental research to explore these relationships.

Implications

Educators who are committed to broadening their experience and learning about video games would benefit from being aware of the results of this study. Parents who are interested in video games would be able to evaluate and choose appropriate video games that promote cognitive benefit. As well, educators could also benefit of this study by incorporating video games in classrooms to develop certain skills. Child and youth professionals and students who are interested in learning about the positive impacts of video games could benefit from the

results of this study. Finally, this study can be very useful for the researchers who are interested in exploring the potential benefits of playing different types of video games in a range of age groups and settings.

Conclusion

The main goal of this research was to examine the extent to which playing different types of video games and its relation to critical thinking and problem-solving behaviour. The findings of the current study indicated that there were no relationships between the types of video game played (action, adventure, sport) and critical thinking and between the types of video games (action, adventure, sport) and problem-solving skills. As well, the results of this study did not support relationships between hours of playing different types of video games with both critical thinking and problem-solving skills. It is possible that these non-significant results are attributable to some of the study design and sample size limitations that were discussed above. This is a pilot study looked at the relationships between the types of video game played with critical thinking and problem-solving. Future research studies can take the lessons learned from this study and go further to examine the long-term benefits of playing different type of video games on critical thinking and problem-solving behaviour.

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Appendix 1

Invitation and Informed Consent

My name is Aml Gadallah, and I am a graduate student in the Master of Arts (Child and Youth Study) program at Mount Saint Vincent University. As part of my degree requirements, I am conducting research under the supervision of Dr. Joan Turner. I am inviting you to participate in my study about *The Effects of Playing Different Types of Video Games and Critical Thinking and Problem-Solving Skills*. The purpose of the research is to determine if there are relationships among types of video game played and critical thinking and problem-solving skills.

A description of the research study and informed consent process follow. If you agree to participate in the survey, please go the Child and Youth Study page and a link to the survey will be there.

Background

Computer games have significantly changed the way children and adolescents spend their free time. According to Statistics Canada (2015), the number of people playing video games has doubled, from 3% to 6% between 1998 and 2010. Also, the amount of time they spent playing video games has also increased from 1 hour 48 minutes to 2 hours 20 minutes in the same period.

Research indicates that there are some positive impacts of playing games on players, and these include behavioural, health, cognitive, and educational benefits. However, one area of interest that has not yet been investigated is the question of the potential positive impact of video game play on critical thinking and problem-solving skills.

Research Purpose: the purpose of this research study is to investigate whether playing video games has effects on critical thinking and problem-solving skills.

Research Method: The one-line survey includes a) brief demographic questions, b) General Media Habit Use Questionnaire, c) Need for Cognition questions, and Problem-Solving Inventory questions. The survey might take 15 to 20 minutes to complete.

Informed Consent

Your participation is completely voluntary, and it entails no personal risk to you. The content of the survey contains no sensitive information. You may decline to respond to any questions that you may be uncomfortable answering and are free to withdraw from the study at any time without penalty. However, once the survey has been submitted, we cannot withdraw your responses as completed surveys are not linked back to participants.

The survey is completely anonymous, and it will not be labeled by a name. Completed survey cannot be linked back to the participant. Efforts made to maintain participants' confidentiality and anonymity by removing any potentially identifying information from the answers to the questions.

Results of this study will be presented as a Master Thesis document to the department of Child and Youth Study at Mount Saint Vincent University.

By clicking on the survey link, you are indicating that you fully understand the above information and agree to participate in this study. When the submit button has been clicked, your survey responses are submitted anonymously to the researcher and cannot be deleted.

If you have any questions about this study, please contact Aml Gadallah at Aml.Gadallah@msvu.ca or Dr. Joan Turner at Joan.Turner@msvu.ca. This research activity has met the ethical standards of the University Research Ethics Board at Mount Saint Vincent University. If you have any questions about how this study is being conducting and wish to speak to someone who is not directly involved in the study, you may contact the Chair of the University Research Ethics Board, MSVU Research office at research@msvu.ca.

The survey will take between 10 to 15 minutes to complete, and by finishing the survey, you have a chance to win a gift card.

APPENDIX 2   POSTCARD

INVITATION

TO PARTICPATE IN A RESERCH STUDY ON VIDEO GAMES

Aml Gadallah, Child & Youth Study Graduate Student is recruiting participants for a study,

"The Effect of Playing Different Types of Video Games

on Critical-Thinking and Problem-Solving Skills"

Background

Research indicates that there are some positive impacts of video game play, including behavioral, health, cognitive, and educational benefits for players. However, one area of interest that has not yet been investigated is the potential impact of video game play on critical thinking and problem-solving skills.

Eligibility

If you are between the age of 18 – 25 years and an undergraduate student at Mount Saint Vincent University you are eligible to participate in the on-line survey available on the **Child & Youth Study at the Mount** Facebook page. All participants will be offered an opportunity to enter a draw for a $25 Sobey's gift card.

How to participate

The link to an on-line survey will be pinned to the top of the **Child & Youth Study at the Mount** Facebook newsfeed. The survey will open with an invitation to participate followed by a description of the informed consent process. If you agree to participate, you will click into the survey where a sequence of 69 questions will follow. At the end of the survey, you will be reminded of the informed consent process and provided information on how to enter your name for a draw. Upon the click of the submit button your consent will be recorded and the data will be entered into the study.

Questions??
Please contact

Aml.gadalah@msvu.ca or joan.turner@msvu.ca (Thesis Supervisor)

Appendix 3

Please take a few minutes to complete the following survey.

Personal Information

1. **Age:**

o   18-20
o   20-22
o   22-24

2. **Gender:**

o   Male
o   Female
o   Other

3. **What is your major of study?**

4. **Are you working a part time job?**
     o   No
     o   Yes
     o   If yes, how many hours

5. **Are you a part time student?**
     o   No
     o   Yes

General Media Habits Use

6. How often do you play video games? (*Please Mark one*)

o   I never play video games (please skip to question 13)
o   About once a month
o   About once a week

- About 4 or 5 times a week
- About 2 or 3 times a week
- Almost every day

7. For how many years have you been playing video games?

   - 0-1 year

   - 2-5 years

   - 5-10 years

   - 10 and more years

8. When you play a video game, in general how much time you spend playing at one sitting?
   - 10- 15 minutes
   - 15-30 minutes
   - 30-40 minutes
   - 1 hour

9. What is your favorite type of video game? and how many minutes do you spend playing this game? (Please write numbers in the spaces below)

10. How often do you play this game?
    - Sometimes
    - Usually
    - All the time

11. On a typical school day (Monday through Friday), how many hours do you play video games during each of the following times? (Please write numbers in the spaces below.)

    - 6 am - Noon   _____ hours/day
    - Noon - 6 pm_____ hours/day
    - 6 pm – Midnight_____ hours/day
    - Midnight - 6 am_____ hours/day

12. On a typical weekend day (Saturday or Sunday), for how many hours do you play video games during each of the following times? (Please write numbers in the spaces below.)

- 6 am - Noon   _____ hours/day
- Noon - 6 pm   _____ hours/day
- 6 pm – Midnight_____ hours/day
- Midnight - 6 am_____ hours/day

Extracurricular Activities

13. On average, how many minutes a day do you spend reading for pleasure?
    - 5-10 minutes
    - 15-30 minutes
    - 1 hour
    - I hour and more

15 What types of extra-curricular activities do you participate in regularly? and how many hours do you spend in this activity? (Please write numbers in the spaces below)

- Team sports
- Music
- Drama
- Individual sport
- Clubs
- Church or religious activities
- Others

Need for Cognition Scale

Direction:

Please read each statement and indicate the extent to which you agree or disagree with that statement, using the scale provided

+4 = very strong agreement   **0 = neither agreement nor disagreement**

  +3 = strong agreement   **-4 = very strong disagreement**

  +2 = moderate agreement   **-3 = strong disagreement**

  +1 = slight agreement   **-2 = moderate disagreement**

                                    -1 = slight disagreement

1. I would prefer complex to simple problems.
2. I like to have the responsibility of handling a situation that requires a lot of thinking.
3. Thinking is not my idea of fun*
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities*
5. I try to anticipate and avoid situations where there is likely a chance I will have to think in depth about something*
6. I find satisfaction in deliberating hard and for long hours.
7. I only think as hard as I have to*
8. I prefer to think about small, daily projects to long-term ones*
9. I like tasks that require little thought once I've learned them*
10. The idea of relying on thought to make my way to the top appeals to me.
11. I really enjoy a task that involves coming up with new solutions to problems.
12. Learning new ways to think doesn't excite me very much*
13. I prefer my life to be filled with puzzles that I must solve.
14. The notion of thinking abstractly is appealing to me.
15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort*
17. It's enough for me that something gets the job done; I don't care how or why it works*
18. I usually end up deliberating about issues even when they do not affect me personally.

The Problem -Solving Inventory

Directions:

Please respond to the items as honestly as possible so as to most accurately portray how you handle such personal problems. Your responses should reflect what you actually do to solve problems, not how you think you should solve them. When you read an item, ask yourself: Do I ever behave this way? Please answer every item.

Read each statement and indicate the extent to which you agree or disagree with that statement, using the scale provided.

1. Strongly Agree
2. Moderately Agree
3. Slightly Agree
4. Slightly Disagree
5. Moderately Disagree
6. Strongly Disagree

1. When a solution to a problem has failed, I do not examine why it didn't work.
2. When I am confronted with a complex problem, I don't take the time to develop a strategy for collecting information that will help define the nature of the problem.
3. When my first efforts to solve a problem fail, I become uneasy about my ability to handle the situation.
4. After I solve a problem, I do not analyze what went right and what went wrong.
5. I am usually able to think of creative and effective alternatives to my problems.
6. After following a course of action to solve a problem, I compare the actual outcome with the one I had anticipated.
7. When I have a problem, I think of as many possible ways to handle it as I can until I can't come up with any more ideas.
8. When confronted with a problem, I consistently examine my feelings to find out what is going on in a problem situation.
9. When confused about a problem, I don't clarify vague ideas or feeling by thinking of them in concrete terms.
10. I have the ability to solve most problems even though initially no solution is immediately apparent.
11. Many of the problems I face are too complex for me to solve
12. When solving a problem, I make decisions that I am happy with later.
13. When confronted with a problem, I tend to do the first thing that I can think of to solve it.
14. Sometimes I do not stop and take time to deal with my problems, but just kind of muddle ahead.
15. When considering solutions to a problem, I do not take the time to assess the potential success of each alternative.

16. When confronted with a problem, I stop and think about it before deciding on a next step.
17. I generally act on the first ideal that comes to mind in solving a problem.
18. When making a decision, I compare alternatives and weigh the consequences of one against the other.
19. When I make plans to solve a problem, I am almost certain that I can make them work.
20. I try to predict the result of a particular course of action.
21. When I try to think of possible solutions to a problem, I do not come up with very many alternatives.
22. When trying to solve a problem, one strategy I often use is to think of past problems that have been similar.
23. Given enough time and effort, I believe I can solve most problems that confront me.
24. When faced with a novel situation, I have confidence that I can handle problems that may arise.
25. Even though I work on a problem, sometimes I feel like I'm groping or wandering and not getting down to the real issue.
26. I make snap judgements and later regret them.
27. I trust my ability to solve new and difficult problems.
28. I use a systematic method to compare alternatives and make decisions.
29. When thinking of ways to handle a problem, I seldom combine ideas from various alternatives to arrive at a workable solution.
30. When faced with a problem, I seldom assess the external forces that may be contributing to the problem.
31. When confronted with a problem, I usually first survey the situation to determine the relevant information.
32. There are times when I become so emotionally charged that I can no longer see the alternatives for solving a particular problem.
33. After making a decision, the actual outcome is usually similar to what I had anticipated.
34. When confronted with a problem, I am unsure of whether I can handle the situation.
35. When I become aware of a problem, one of the first things I do is try to find out exactly what the problem is.