Video game engagement: gender differences, preferred mode of play and problem solving

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Submitted in partial fulfilment of the requirements of the BA Hons in Psychology at Dublin Business School, School of Arts, Dublin.

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March 2018
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I would like to thank my supervisor Trish for her support and guidance with this project. Also, thanks to my family for the encouragement, support and tolerance with my frequent disappearances behind the laptop screen. Thank you to all those who participated in this study. And thanks also to the staff at DBS who were an integral part of my education over the past four years.
Abstract

This study’s objective was to examine if there are differences in video game engagement levels across single and multiplayers, and males and females. It further examined if there are differences between single players and multiplayers in independent and interdependent approaches to problem-solving. Ninety-nine participants of mixed gender were recruited by means of an online survey. The Game Engagement Questionnaire (GEQ) was used to measure the subjective experiences of individuals during game participation, and the Independent-Interdependent Problem-Solving Scale (IIPSS), was used to examine dispositional preferences to problem-solving. The analysis showed that there are no significant differences between gender, and mode of play in engagement levels. No statistical differences were found between single or multiplayers in approaches to problem-solving. Single player mode was revealed as the dominant preference, and there is an implication that game genre may be influential in engagement levels. The findings, and implications for future studies are discussed.
Introduction

The information age has seen a revolution in the video gaming industry. Advancements in high resolution graphics that create better environments, textures and characters, serve to give the perception of a more realistic gameplay experience. Further, high speed broadband allows for online play that every major gaming console offers.

One aspect currently of interest in video gaming is engagement - the individual’s subjective experiences during play. The purpose of this study is to examine if there are gender differences in engagement levels, notwithstanding popular opinion that video gaming is predominately associated with young male adolescents. Secondly, it will examine if favoured mode of play, single player (the preference to play alone), or multiplayer (the increasingly popular preference for collaborative (or competitive) play) is a factor in gamer engagement. Thirdly, as many games require the use of higher cognitive skills such as problem solving, this study will examine whether mode preference is related to individual’s approaches to real-life problem solving.

Popularity of gaming

In addition to actually playing the games, a world-wide 665 million people log in to video sharing websites such as Twitch or YouTube to access on-demand videos or live streams of their favourite games. The global interactive media market has reached €95 billion in 2017. Furthermore, the recent introduction of virtual reality games serves to secure an optimistic future of the industry, and by 2020 it is estimated that players will spend €3.8 billion on immersive gaming (Superdata, 2017). Although it is conceivable that generally, engagement levels in Virtual Reality (VR) games would be higher. However, they are relatively new to the
market (last 18 months), and not everybody owns, or has access to VR add-ons to their console. So, in view of this, the research will include all gaming platforms and genres in this study.

**Immersion and Presence**

*Immersion and presence* are two interlinked terms currently used in describing engagement in video gaming. *Immersion* is the sense of being present in the game while retaining some degree of awareness of surroundings is a common experience for players (Brockmyer et al. 2009). Closely linked to immersion is *presence* which is the experience of being inside the virtual environment while retaining a normal state of consciousness (Bracken & Skalski, 2006).

Games with consistency and a rich mental model of the virtual environment, coupled with high quality imagery have been proven to have an impact on immersion and presence (Bracken & Skalski, 2006). The games characteristics that lead to these two factors in engagement, include a completeness of sensory information. The familiarity of the mental model of the game environment leaves fewer blanks to be filled in by the player. The player’s cognitive resources are occupied with cognitively demanding environments thus allowing immersion to weaken the player’s realization that they are playing a game. Open-world (3D) games in particular involve using multiple channels of sensory information. For example, in war games, the audio and visual details of distant gunfire or explosions not primarily relevant to the task in question, do not serve as a distraction, rather an enhancement of the realism. Additionally, a strong plot or narrative is necessary to generate immersion or spatial presence (Madigan, 2010).

The sense of being inside the juxta positional spatial environment that the individual experiences, coupled with the ecological validity of the environment can be considered dimensions of presence (Freeman, Lessiter, Pugh and Keogh, 2005). High image quality versus
low image quality were used to measure participant’s spatial presence in Bracken and Skalski’s (2005) study. The first person point of view nature of the game played was expected to enhance player’s spatial presence. Although, the results did not suggest higher presence with high image quality, the authors suggest that gaming skills may have been a factor.

**Cognitive Flow**

Of particular interest in this study is cognitive flow, which involves extreme game focus – a critical level of engagement, and pleasure of using skills to achieve the game’s goals. The sense of accomplishment is further enhanced by feedback on performance. (Moneta & Csikszentmihalyi, 1996, 1999).

Hungarian psychologist Mihily Csikszentmihalyi (1990) evaluated flow, and outlined that people are happiest when in a state of flow. He described flow as

> Being completely involved in an activity for its own sake. The ego falls away. Time flies. Every action, movement, and thought follows inevitably from the previous one, (…). Your whole being is involved, and you're using your skills to the utmost. (as cited in Geirland, 1994).

Csikszentmihalyi claimed that cognitive and emotional states result from the interaction of the individual’s skill and difficulty in the task. Low skill coupled with difficult tasks can lead to anxiety. Alternatively, high skill and easy tasks can lead to boredom. A flow state results from proportional skill and difficulty (2011).

The probability of flow states in video games are increased by certain game characteristics that create an equilibrium between skill and difficulty. Included in these are having concrete goals within the game with manageable rules. The achieving of goals and subsequent rewards is a reinforcing factor in game play. It is when the rules are vague with difficult goals that the flow state breaks down, and players disengage from the game. A second
characteristic of a flow state is the limits of a players capabilities and that the actions demanded fit within the limitations of those abilities. Failure to do so, results in stress and frustration with the game, which subsequently affects flow. Other flow characteristics include timely performance feedback for the construction of the action-outcome associations, and the removal of any extraneous information that serves to inhibit the player’s concentration as there are limitations on how much information a player can process at any given time. (Baron, 2012).

Psychological Absorption

As flow induces an altered state of consciousness, it can be considered synonymous with psychological absorption, which also involves being in an altered state of consciousness. Funk, Chan, Brouwer, & Curtiss, (2006) qualitative study examined the psychological absorption of gamers. However, although similar to cognitive flow, absorption differs, as the type of affect – both positive and negative, experienced during play is experienced differently by players according to this study. Rational thought and moral evaluation are suspended, and it is possible that mental models for aggression could be developed unconsciously according to a study on video game engagement and aggression. The rewards for violent acts within the game can lead to a desensitization to violence in real-life (Brockmyer et al, 2009). This study will examine the above factors of engagement and the gender differences if any, in levels of engagement in video gaming.

Engagement and gender

There is a common ideal that video gaming is associated with males. This view is shared by 57% of women, and men are more likely to call themselves “gamers” (15% vs. 6%), according to one survey (Duggan, 2015). Further evidence of this view is the fact that women remain outsiders in the gaming industry. Recent figures from The Independent
Game Developers’ Association (TIGA) revealed that 14% of women are currently working in the UK gaming industry, with the United States presenting similar figures (Ramanan, 2017).

One explanation may be that despite some games having a strong female protagonist (“Tomb Raider’s” Laura Croft (2013) for example), and that many role-playing games (RPGs) feature an option to choose the gender of the protagonist, the majority of games, particularly the action genre, continue to portray sexualized female characters (Ivory, 2006). Furthermore, negative stereotypes have been seen to effect female performance relative to males, on gaming tasks (Kaye, and Pennington, 2016). However, there has been a steady rise in the female players in the last ten years. In the United States females account for 42% of all players, with mobiles as the largest digital platform (Statista, 2017).

Previous studies have suggested that the amount of time spent playing video games was significantly higher in males than females (Ogletree & Drake, 2007; Winn & Heeter, 2009). Gender differences in engagement may be due to motivation. Studies have shown that social interaction may be a dominating motivational factor for females, and achievement and personal gain the reason for males (Heeter et al, 2009; Osbourne, 2008). Additionally, game genre is significant in gender differences. Gender-stereotyped games are preferred by males rather than gender-neutral games. According to the Heeter study (2009), males and females were asked to design a game. The females tended to design gender-neutral games, with real-world settings with little or no violence, whereas the males targeted a male audience.

Additionally, there are reported gender differences in game mode – online and offline. Males more so than females tend to be drawn towards online play (Yang, 2011). Conflicting research however, indicates that although males correspond with the “hard core” gamer profile, the increasingly popular Massively Multi-used Online Role-playing Games
(MMORPG) appears to be dominated by females who play for longer periods of time (Terlecki, 2011)

The gaming habits as a social activity differs between males and females. Females tend to play video games as a break from boredom, thus fitting in play around other activities, thereby having less time to devote to playing. Males, on the other hand are inclined to take it more seriously as a form of entertainment, talk about it more, and perhaps consider it a priority (Dawson et al, 2007). The sense of achievement involved in the flow state, one aspect of engagement in video gaming can be related to the individual’s motivation for play. Dauphin and Heller (2010) suggest that gender is related to engagement in that males become more engaged in gaming than females. There is neurological evidence to support this, Hoeft, Watson, Kesler, Bettinger, and Reiss (2008) fMRI study found increased activity in the mesocorticolicimbic centre of male participants during performance of a territorial game. This brain region is typically associated with reward. The increased reward inevitably leads to motivation to play. Conversely, although Williams, Martins, Consalvo, and Ivory (2009) found differences in achievement and social factors between males and females, there were no gender differences in engagement (immersion) factors.

**Engagement and game mode**

A further aspect of this study will examine game engagement in relation to single player/multiplayer and online/offline participation. For the purpose of this research the term *multiplayer* will encompass online play of any description whether with friends or persons unknown to the player. Accordingly, the term *single player* will be used to define those players who prefer to play video games alone, with or against computer generated allies or opponents.

The online modes that most game developers currently offer, that no doubt increase the replayability of the game, offers the player social interaction with challenging interactive
narratives. There can be no doubt that the industry is consistently pushing forward co-operative and competitive online gaming. There is a certain appeal to players that connection to other players or friend can be achieved in an instant. All ten of the top-selling games worldwide in 2016 include the multiplayer option, with *Tom Clancy’s The Division* (2016) offering an online-only mode of play (Statista, 2017). Massively multiplayer online role-playing games (MMORPGs) which involves the interaction of large number of players within a virtual world, in particular, have increased in popularity over the past several years. Role playing games (RPGs) in which the player assumes the role and the actions of an avatar (computerized persona) positioned what would usually be a fantasy or science-fiction world that continues to exist and change when the player is away from the game. The primary goal for the player is the development of their avatar in order to progress - by way of earning experience points and levelling up through the game. The principle motivations for playing MMORPGs or MMOGs in general, are the social and immersive elements as discussed by Yee, Ducheneaut and Nelson, during their development of the Gaming Motivations Scale (2012). These elements allow players a form of escapism from everyday lives, and form alliances with others with similar interests. These online communities have developed their own language for the co-operative play, along with social rules and restrictions. Communication, or chat with other players by use of text and headsets serve to enhance the shared narrative experiences and the social experience. Conversely, playing with family or friends only can be motive for continued play of a game (Whitbourne, Ellenberg, & Akimoto, 2013). Playing against friend’s elicited greater spatial presence and engagement compared to playing against either a stranger or against a computer according to Ravaja, Saari, Turpeinen & Laarni (2006).

The gaming industry has progressed significantly since physicist William Higinbotham’s tennis game in 1958 which is widely considered the first video game (APS Physics, 2008). With the gaming industry shifting inevitably towards online and multiplayer
gaming, there are some individuals whose personal preference is towards the single player mode of Player versus Environment (PvE) where players compete against computer-controlled opponents. The generation of players who grew up playing alone – as this was the only option, enjoy the personal responsibility of ‘saving the world’ without a team around them. With the first person perspective, essentially, the player is not merely controlling the avatar – they are the avatar. An example of this, are the popular survival horror games that draw the player into the fictional, atmospheric world, that target the evolved defence systems that subsequently produce fright responses (Lynch & Martins, 2015).

Popular media has examined the single versus multiplayer preference, some would argue that the multiplayer mode with its higher degrees of competitiveness, cannot match the myriad of emotions that the single player experience evokes. A recent Forbes survey found that two thirds of video gamers prefer to play alone (Tracy, 2016). Although there has been little research in the area of the single player in gaming, Hainey, Connolly and Boyle (2010) empirical research focused on differences of motivations in relation to single/multiplayer preferences in game participation, citing the social aspect as a significant difference between the two modes – those who preferred multiplayer considering it less of a lonely activity. In short, the results suggested that mode preference has less of an impact on motivations in general.

This research will examine which of the two preferred modes are related to higher levels of engagement. In regards to player mode and engagement, the literature shows conflicting conclusions. Schoenau-Fog (2011) explored the engagement process in digital gaming, citing it as an “essential element of the player experience” (p. 1). Among the listed categories of player engagement is the social aspect namely the competitive features of the game. Unbalanced competition, or too much of it may lead to frustration and subsequent disengagement. Further, Schoenau-Fog asserts that the multiplayer option is the sole reason
that compels the individual to play the game. Conversely, while examining video game motivation Westwood and Griffiths, (2010) found that individuals with a strong preference for single play, are less susceptible to game engagement due to a lack of identification with in-game characters, which is invariably due to strict personal time limits on play.

**Game mode and problem-solving**

Problem-solving, the cornerstone of human intelligence has been described as a “cognitive processing directed at transforming a given situation into a goal situation when no obvious method of solution is available to the problem solver” (Mayer as cited in Eysenck & Keane, 2010, p. 459). Approaches to tangible problem-solving can be distinguished between the independent method – individuals who prefer to work alone, and the interdependent or collaborative method – an approach that involves consultation with others. Problem-solving strategies depend on the unique situation. Some research supports the argument that cooperative strategies are more effective (Qin, Johnson & Johnson, 1995; Amitia, 1988). Additionally, differences were observed in student’s long-term retention of problem-solving strategies, in those who used an interdependent approach, rather than working independently (Duren & Cherrington, 1992). However, research in this area has been limited to applications in the academic world. Furthermore, the relationship between problem-solving strategies in real-life and video games remains unclear in the literature.

Gaming researcher Jane McGonigal (2010), claims that because gamers spent eighty percent of the time failing while playing the game, it encourages them to try harder to succeed. And by focusing on problems within a games framework, which is obviously more dramatized, may help to compartmentalize real-life issues. Research has shown a relationship between players “real” and “virtual” self. Yee, Ducheneaut, Nelson, and Likarish (2011) study found players with extroverted personalities tended to prefer group rather than solo activities in their
virtual world. This research addresses preferred mode of play (single or multiplayer) as an indication of individual’s mental processes, specifically their approach to problem-solving.

There are a myriad of games available that claim to train the core cognitive abilities, with the accessibility of Android and iOS (Lumosity (2007), Elevate (2017), and Fit Brains Trainer (2017). However, regardless of the preferred platform, many genres of games with both single and multiplayer option, problem-solving is central facet. DayZ (2013), the multiplayer open world survival modification game, where the player must use problem-solving skills to survive, by scavenging the virtual world for essential provisions. In the cooperative multiplayer mode, players team with others, and use these skills to survive a zombie apocalypse. For the single player racing games such as Forza (2017) the player must make accurate decisions while under pressure, and mobile puzzle game Cut the Rope (2013) was shown to improve executive brain functioning (Oei & Patterson, 2014).

There has been empirical research regarding the relationship between the learning principles of video games and the promotion of problem solving. Shute, Ventura & Ke (2015) examined undergraduate’s cognitive skills, including problem-solving, before and after gameplay, using two games, one a mainstream a first-person puzzle-platform video game (Portal 2), and an equally popular but specific brain training game (Lumosity). The results showed higher scores on problem-solving in Portal 2, than on the brain training game (Lumosity). Adachi & Willoughby’s (2012) research discovered a relationship between strategic video games and increased self-reported problem solving skills and subsequent indirect positive relationship with academic grades. One purpose of this current research is to examine individual’s preference for mode of play and their approach to problem-solving. It will question if there are differences between preference for playing alone or with others in approaches to real-life problem solving.
Summary and Hypothesis

There has been much research in the psychological aspects of gaming, from examining gaming and addiction (King, Griffiths & Delfabro, 2009), to moral disengagement and gaming (Ewell, Guadagno, Jones and Dunn, 2016), and motives for playing (Demetrovics et al., 2011). Previous studies have examined the psychological aspects of playing online multiplayer games, such life interference and psychopathology. Berle, Starcevic, Porter and Fenech (2015), found that frequency and intensity of play was a major factor regardless of mode, having questioned 1945 participants online. To address the gap in the literature, however, the primary objective of this study is to discover what we can learn from engagement in one of the most popular forms of entertainment for millions of individuals worldwide. Subjective measures of engagement and approaches to problem-solving will be used for this research.

In relation to the above perspective, this study will explore the social aspects of gaming and questions if social interaction is an indicative factor of video game engagement, by way of single or multiplayer preference. This study will analyse levels of video game engagement, and will explore whether gender plays a role in game engagement. Further, it will examine whether the cooperation and cohesion associated with multiplayer mode, or the preference to playing alone in single player mode is a predictor to individual’s approach to real-life problem solving.

The hypothesis in this study are:

H1: There will be a significant difference in levels of engagement across preferred multiplayer or single player mode.

H2: There will be a significant difference in levels of engagement across males and females.

H3: There will be a significant difference in the independent and interdependent approaches to problem solving across the preferred single or multiplayer mode of play.
Methodology

Participants

The current study comprised of ninety-nine (n = 99) participants, consisting of persons of mixed gender (male, n = 53, female, n = 43, other, n = 3), (table 1), with a minimum age requirement of 18 years, and no upper age limit (table 2). Using a non-probability snowballing sampling technique, the participants were recruited by means of an online survey. The survey was anonymous and confidential, and participants were given the opportunity to consent prior to completion of same. The participants were offered no financial inducements to take part in the study.

The survey contained initial demographic questions, a short questionnaire regarding video gaming habits, and a questionnaire to examine levels of engagement in video gaming. A further questionnaire regarding approaches to problem solving was included. The researchers contact details were included on the last page of the survey. The participants belong to naturally formed groups, therefore are not randomly assigned.

Tables 1 and 2 below illustrate the descriptive statistics for participants and the age range.

Table 1 Participant Frequency and Percentage of Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>53</td>
<td>53.5%</td>
</tr>
<tr>
<td>Female</td>
<td>43</td>
<td>43.4%</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table 2 The Mean and Standard Deviation of Participant Age Range

<table>
<thead>
<tr>
<th>No of Participants</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>99</td>
<td>18</td>
<td>60</td>
<td>34.26</td>
<td>10.10</td>
</tr>
</tbody>
</table>
**Design**

The purpose of this study is to examine game engagement in relation to single player/multiplayer and online/offline participation. For the purpose of this research the term *multiplayer* encompasses online play of any description whether with friends or persons unknown to the player. Accordingly, the term *single player* is used to define those players who prefer to play video games alone, with or against computer generated allies or opponents.

This is a comparative study applying a quasi-experimental design. It is quantitative, and is subject to statistical assumptions and conditions. The analytical objectives are to quantify variation. The independent variables, preferred mode of play (single and multiplayer) in the first hypothesis, and gender (male and female) in the second hypothesis are identified and their effects on the dependent variable (levels of engagement) were measured. The third hypothesis examined the differences between participants preferred mode of play; single or multiplayer (independent variable), and approaches to problem-solving; independent or interdependent (dependent variable).

**Materials**

The survey, created from Google Forms, contained demographic questions regarding age and gender, and general questions on gaming habits (hours spent on play, genre etc.) (appendix C) Two questionnaires on video game engagement and approaches to problem-solving were included. The survey concluded with a debrief sheet which included a brief message with details of helplines for gaming addiction, and the researchers details.

The Game Engagement Questionnaire (GEQ) (Brockmyer et al. 2009) (appendix A) was used to measure the subjective experiences of individuals during game participation. Engagement in video games encompasses the individual’s subjective experience during play.
The experience while retaining some awareness of surroundings (Immersion), the experience of being inside a virtual environment (Presence), and the type of affect encountered by the individual during engagement (psychological absorption). In addition to this, is the enjoyment of the sense of control and concentration during the process of performing an intrinsically rewarding activity (Flow).

**Scoring of the GEQ.**

The self-report questionnaire contains nineteen questions, and is scored using a 5 point Likert Scale to measure the participants agreement with a number of statements regarding the immersion, presence, flow and absorption experienced during game play. The severity of the range of statements are measured. Each item is scored from 0 (very frequently) to 5 (never). The scores are calculated by frequency of responses to the statements regarding video game engagement - the higher score will indicate higher levels of engagement. Participants are asked how much each statement relates to them, (1 “never” to 5 “very frequently”). Example items include “I lose track of time”, and “If someone talks to me, I don’t hear them”. The validity and reliability (Cronbach’s alpha .85, item reliability of .96) of the GEQ was assessed by Brockmyer et al. (2009), as discussed in Norman’s (2013) review of the questionnaire. Thus, the GEQ provides a theoretically meaningful measure of levels of engagement in playing video games. For the purpose of this study, further assessment of the validity and reliability is observed in the results section.

Differences between players approach to play (alone or with others) and their engagement in the game were examined. Additionally, differences between males and females in video game engagement were examined.

The Independent-Interdependent Problem-Solving Scale (IIPSS version 2) (Rubin, Watt, & Ramelli 2012), (appendix B) was used to examine dispositional preferences to problem
solving. Approaches to tangible problem-solving can be distinguished between the independent method – individuals who prefer to work alone, and the interdependent or collaborative method – an approach that involves consultation with other people.

**Scoring of the IIPSS.**

The self-report questionnaire contains ten questions, and is scored using a 7-point likert scale. The participant’s responses to the independent problem-solving questions are reversed. The average score of all items will be calculated. The scores are calculated by frequency of responses to the statements. Higher scores indicate a tendency to approach problem-solving in an independent manner. Participants are asked how much each statement relates to them, (1 “strongly agree” to 7 “strongly disagree”). Example items include “I value other people’s help and advice when making important decisions”, and “When faced with a difficult personal problem, it is better to decide yourself than to follow the advice of others”. The scale has good reliability, with a single factor structure (eigenvalue = 3.96) and good internal consistency (αs = .77 & .80), (Rubin, Watt, & Ramelli 2012), For the purpose of this study, further assessment of the validity and reliability is observed in the results section.

**Procedure**

Links to the survey were posted on social media (Facebook and Twitter) by the researcher. Additionally video game bloggers were approached by email and asked to share the survey on their websites and social media. Information about the survey content was posted with the link informing potential participants that the study will involve those who actively play video games.

The criterion for participating in the study involved informed consent, and the participants were aged 18 and over. To ascertain eligibility, general information on the purpose of the research was disclosed with the survey link. Further details of the study were included
in an information cover sheet, which also included instructions on how to complete the survey. Participants were instructed to read and respond to the questionnaire. The participants were advised that participation was optional, with complete anonymity and confidentiality, and further advised that collected data from the survey will be securely stored in a limited access electronic files. They were advised that completion and submission denoted consent to participate.

The survey was created using Google forms, and subsequently downloaded from Microsoft Excel format to SPSS for coding and analysis. Independent T-tests were used to examine all three hypothesis.

**Ethical considerations**

Ethical approval to conduct the current research was granted by the Ethics committees in Dublin Business School. In adherence to the Code of Professional Ethics (PSI), the four overall principles; respect for the rights and dignity of the participant, competence, responsibility, and integrity have been considered. With minimal risk to participants, the current research was directed at adults aged 18 years and over who actively participate in video gaming. Additionally, the researcher’s contact details were included to facilitate any queries regarding the survey.
Results

The data from the survey was examined. For hypothesis one and two, the participants (n = 99) score was calculated from the Game Engagement Questionnaire (GEQ) using independent samples t-tests. Below are the descriptive and inferential statistics for each of the variables in question. Included here, are tables and graphs representing the findings.

Hypothesis 1: Examined differences in levels of game engagement between single and multiplayer.

Assumptions

Cronbach’s Alpha was used to access reliability of the GEQ measure (Brockmyer et al. 2009). The internal consistency score was .907. There were equal variance between both groups (single player = 192.75, multiplayer = 205.25). The Levene’s test showed a significance of .733 therefore the assumption of homogeneity of variances was not broken. No extreme scores were found. Q-Q plots for both groups displayed normally distributed data. A Shapiro-Wilk test showed normality (single player = .733, multiplayer = .183). Tests of normality showed a normal distribution for engagement and single player mode, however there was a moderate negative skewness (-.56) for multiplayer mode (appendix D).

Descriptive statistics

Table 3 below, displays the descriptive summaries for the data collected, presenting the mean and standard deviation for the single or multi-player preferred mode of play. Included in the table is the result of the reliability test, Cronbach’s Alpha.
Table 3: *Descriptive Statistics for engagement and single and multi-player mode of play preference*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of Players</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single player Engagement</td>
<td>73</td>
<td>52.83</td>
<td>13.88</td>
<td></td>
</tr>
<tr>
<td>Multiplayer Engagement</td>
<td>26</td>
<td>55.84</td>
<td>14.32</td>
<td>.907</td>
</tr>
</tbody>
</table>

It is apparent that the highest engagement mean score was obtained for multi-player as preferred mode of play, while the single player preference showed the lower mean score. The engagement inventory was found to have relatively high internal consistency.

**Inferential statistics**

In examining video game engagement levels, it was predicted that there would be a significant difference in levels of engagement between individuals who prefer to play alone (single player) and online multiplayer mode.

An independent samples t-test found that there was no statistical significant difference between engagement levels of single player or multiplayer mode of play ($t(97) = -.94, p = .349$). Multiplayers ($mean = 55.84, SD = 14.32$) were found to have higher levels of engagement than single players ($mean = 52.83, SD = 13.88$). The 95% confidence limits shows that the population mean difference of the variables lies somewhere between -9.35 and 3.33. The observed power was .15. Therefore the null cannot be rejected.
Hypothesis 2: Examined differences in levels of game engagement between males and females.

Assumptions

Cronbach’s Alpha was used to access reliability of the GEQ measure (Brockmyer et al. 2009). The internal consistency score was .907. There were equal variance between both groups (males = 177.87, females = 231.50), the Levene’s test probability value is .938, therefore the assumption of homogeneity of variances was not broken. No extreme scores were found. Q-Q plots for both groups displayed normally distributed data. A Shapiro-Wilk test showed normality (males = .583, females = .284). Tests of normality showed a normal distribution for engagement with both groups (appendix E).

Descriptive statistics

Table 4 below, displays the descriptive summaries for the data collected, presenting the mean and standard deviation for males and females. Included in the table is the result of the reliability test, Cronbach’s Alpha.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Number of Players</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement Males</td>
<td>53</td>
<td>53.67</td>
<td>13.33</td>
<td></td>
</tr>
<tr>
<td>Engagement Females</td>
<td>43</td>
<td>53.30</td>
<td>15.22</td>
<td>.907</td>
</tr>
</tbody>
</table>

Males presented the higher engagement mean score over females by a minor degree.

The engagement inventory was found to have relatively high internal consistency.
**Inferential statistics**

In examining video game engagement levels, it was predicted that there would be a significant difference in levels of engagement between males and females.

An independent samples t-test found that there was no statistical significant difference between engagement levels of males and females (t(94) = .13, p = .897). Males (mean = 53.67, SD = 13.33) were found to have higher levels of engagement than females (mean = 53.30, SD = 15.22). The 95% confidence limits shows that the population mean difference of the variables lies somewhere between -5.41 and 6.17. The observed power was .67. Therefore the null cannot be rejected.

**Hypothesis 3:** Examined differences in independent and inter-dependent approaches to problem solving across the preferred single or multiplayer mode of play.

For hypothesis three, the participants score was calculated from the Independent and Interdependent Problem-solving Scale (IIPSS) using independent samples t-tests. Below are the descriptive and inferential statistics for each of the variables in question. Included here, are tables representing the findings.

**Assumptions**

Cronbach’s Alpha was used to access reliability of the IIPSS measure (version 2) (Rubin, Watt, & Ramelli 2012). The internal consistency score was .827. There were equal variance between both groups (single player = 85.30, multiplayer = 127.72). The Levene’s test showed a significance of .432 therefore the assumption of homogeneity of variances was not
broken. No extreme scores were found. Q-Q plots for both groups displayed normally distributed data. A Shapiro-Wilk test showed normality (single player = .812, multiplayer = .591). Tests of normality showed a normal distribution for independent problem solving with both groups (appendix F).

**Descriptive statistics**

Table 5 below, displays the descriptive summaries for the data collected, presenting the mean and standard deviation for single and multiplayer mode of play. Included in the table is the result of the reliability test, Cronbach’s Alpha.

<table>
<thead>
<tr>
<th>Variable</th>
<th>No of participants</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single players</td>
<td>73</td>
<td>35.18</td>
<td>9.24</td>
<td></td>
</tr>
<tr>
<td>Independence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiplayers</td>
<td>26</td>
<td>32.39</td>
<td>11.30</td>
<td>.827</td>
</tr>
<tr>
<td>Independence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is apparent that the highest mean score was obtained for single players, while multiplayers showed the lower mean score. The independence inventory was found to have relatively high internal consistency (.827).

**Inferential statistics**

It was predicted that there are significant differences in independent and interdependent approaches to problem solving across the preferred single or multiplayer mode of play.
An independent samples t-test found that there was no statistical significant difference between independent approaches to problem-solving between single players and multiplayers \((t(97) = 1.25, p = .216)\). Single players (mean = 35.18, SD = 9.24) were found to have a higher independent approach to problem-solving than multiplayers (mean = 32.39, SD = 11.30). The 95% confidence limits shows that the population mean difference of the variables lies somewhere between -1.65 and 7.24. The observed power was .23. Therefore, the null cannot be rejected.

**Additional descriptive statistics**

The graphical representations below present further descriptive statistics regarding participant’s preferences on gaming platforms, genre and typical daily time spent on playing video games.

*Graph 1: Bar chart presenting the preferred platform and game genre.*
It is apparent from the above bar chart (Graph 1) that a high percentage of participants listed mobile as a preferred video game platform. Additionally, large amount of participants included puzzle as a preferred genre.

Graph 2: Number of hours spent on play per day

The above pie chart (Graph 2) the typical number of hours participants spend playing video games per day. It is apparent that the highest amount of time on play falls between zero to three hours.

To summarise, no significant differences were found in engagement levels between the preferred single player and multiplayer mode of video gameplay, or between males and females. Additionally, no significant differences were found in the independent and inter-dependent approaches to problem-solving across the preferred single or multiplayer mode of play. Therefore, the null, in all three hypothesis was not rejected.
Discussion

The aim of this study was to explore the social aspects of gaming and questioned if social interaction is an indicative factor of video game engagement by way of single or multiplayer preference. Levels of video game engagement were analysed in both males and females. It further examined if preferred mode of play, single or multiplayer was a predictor to individual’s independent or inter-dependent approaches to real-life problem solving.

The first hypothesis predicted differences between the preferred single player and multiplayer mode in levels of engagement. The results demonstrated that there were no significant differences between the two preferred modes of play in engagement levels, although multiplayers were found to marginally higher engagement levels. The second hypothesis examined if there were differences in levels of engagement between males and females. Males were found to have slightly higher engagement levels in video game engagement than females, however, the results showed no significant differences between the two variables. The third hypothesis predicted a difference in the independent and inter-dependent approaches to problem-solving across the preferred single or multiplayer mode of play. Although no statistical differences were found between the single player and multiplayer mode in approaches to problem-solving, single players were found to have a higher independent approach to real-life problem-solving that multiplayers. Therefore, the findings of this study do not support the hypothesis.

Game mode and engagement

The primary objective of this research was to address the gap in the literature regarding the subjective nature of individuated playing experiences in one of the most popular forms of entertainment for millions of individuals worldwide. According to previous research, engagement in video gaming is viewed as an essential element to the player experience
(Schoenau-Fog, 2011). Further, Schoenau-Fog asserts that it the competitive features of the multi-play option that draws the player into the game. Added to this is the conception that in multiplayer modes, the player is completing against in-game characters that possess human intelligence. Conversely, another factor of relevance is that during single play, the player is alone with no human distractions such as the use of the in-game chat options, which may make the experience more engaging.

This was primarily an exploratory research involving engagement in gaming. Although, there has been little research in mode of play and engagement, according to Westwood and Griffiths (2010), time spent on play may be a relevant factor. Strict personal time limits are cited as reason for less susceptibility to engagement in single play, and subsequent lack of identification with in-game characters. The findings of this study indicate that participants generally tend to spent less than three hours per day on active gaming, which supports this theory.

Additionally when examining single versus multiplayer in engagement levels, one could take into account game genre as a factor. In this study, 25% of participant responses indicated that puzzle was a preferred genre. Puzzle games are increasingly popular, with Angry Birds (2009), Candy Crush Saga (2012) and The Room 3 (2015), among the most popular, which are incidentally, all single player games (Superdata, 2018). In order to progress through the puzzle game, the player is required to win consecutive levels. A dominant feature in many puzzle games is the use of “lives” available to the player which limits the time spent on the game, a possibly impeding engagement levels.

**Preferred platform**

A prominent element that emerged from the data is the high use of mobile as a preferred platform. In 2016, mobile games generated $41 billion in revenue, compared to retail sales of
consoles of $26 billion (Superdata, 2017), thus showing an apparent shift from console to mobile platform. The portability and convenience of hand held devices coupled with the availability of often low cost, and sometimes free games can be considered incentives to play.

The data in the current research highlighted that over 70% of participants listed single player as preferred mode, in addition to the 68% who cited mobile devices as a preferred platform. Although mobile devices offer a vast amount of multiplayer options, the concept of these games as used for boredom breakers or time-killing activities, thereby requiring a shortened focused attention span, suggests that these two elements may have be indicators of lower engagement levels. In accordance with previous research regarding certain elements of engagement, it is conceivable that the alerted states of consciousness, and the longer playing sessions required in cognitive flow (Baron, 2012) and psychological absorption (Moneta & Csikszentmihalyi, 1996, 1999) in particular, may have an implication on choice of platform as engagement factors.

**Gender and engagement**

The second aim of this study was to examine if gender plays a role in the individual’s objective experience during video game play. Previous research indicates that the video gaming is largely associated with males rather than females, a view shared by women according to Duggan (2015). Additionally, it was found that males spent significantly more time on gameplay than females (Olgetree & Drake, 2007). A mounting body of evidence highlights a propensity for engagement in males, however, game preference was cited as a possible factor (Uz & Cagiltay, 2015; Ream, Elliot & Dunlap, 2013). Dauphin and Heller (2010) found a significant relationship between gender and video game engagement with males appearing more involved than females.
Although there is little evidence to the contrary, there have been some suggestions that females are likely to engage more in gaming from a motivational perspective. Considering that in-game challenge and performance are integral elements in flow states, Serrone (2012) study found females more challenged by video games and were more likely to report more immersion during play. Similar research conducted by Yee (2006) found females scores on immersion, higher than males. Correspondingly, Procci, James and Bowers (2013), examined gender amongst other variables on video game engagement, and found that the ability to experience levels of engagement was not affected by the individual differences.

The results of this study appears to defend these previous studies, and that during gameplay, gender does not determine levels of engagement. The conclusion is that as females are found to play just as much video games as males (Statista, 2017), and supporting Terlecki et al. (2011) findings, that there are almost as many similarities as differences between the genders in gaming preferences, it is conceivable that engagement levels between males and females may not differ (Williams, Martins, Consalvo & Ivory, 2009).

**Game mode and approaches to problem-solving**

This study also addressed tangible problem-solving and mode of play. The purpose was to examine if the preference to playing alone (single player mode) would suggest a tendency for an independent problem-solving approach in real-life situations, or if the preference to play with others (multiplayer mode) suggests an inclination to approach real-life problems with an interdependent/collaborative approach. As everyday problem-solving often occurs in a social context, this research attempts to understand whether social interaction in video gaming is influential on the problem-solving process.

There have been numerous studies that focus on approaches to problem-solving ranging from gender and collaborative problem-solving (Vancouver & Ilgen, 1989; Margrett, &
Marsiske, 2002), to examining age as context (Artistico, Cervone & Pezzuti, 2003; Berg, 1989; Berg, Meegan, & Klaczynski, 1999). The relationship between problem-solving strategies in real-life and video games remains unclear in the literature. However, relationships between general problem-solving styles and in-game problem-solving strategies have been found (Hamlen, 2017), with some differences observed in game genres. Interestingly, Hancock (2010) when comparing modes, found that individuals with a preference for multiplayer online games had significantly lower social problem solving skills.

This research revealed no statistical differences between the two approaches across the modes of play. Single player as preferred mode of play were found to have a higher independent approach to problem-solving than multiplayers. It is important to note however, that the sample revealed single players outnumbered the multiplayer by almost three to one. The conclusion is the uneven distribution may be a contributing factor in the interpretation. Future studies may benefit from separating the variables into two distinct categories to facilitate a balanced analysis of the data.

**Strengths and limitations**

This was primarily an exploratory study which gave an overview of participants gaming habits, and highlighted the popularity of mobile gaming. Little research has be done in gaming mode preference and individual’s subjective experiences in video gaming, hence this study has created a structure for further research not only in relation to engagement, but also the cognitive benefits to playing video games by way of problem-solving approaches. In addition, the questionnaires used in this study provided a well-structured method to quantify the subjective player experience in engagement, and approaches to tangible problem-solving.
**Limitations and future research.**

The current research has limitations which may be addressed in future studies. Despite its high reliability and validity properties, the Game Engagement questionnaire (Brockmyer et al. 2010) used for this study was developed in relation to examining player engagement in a particular genre - violence in video gaming. Future studies in player engagement, could incorporate genre as a variable, and the data from this study indicated a strong preference for single player puzzle games, which if examined as separate variables, may be influential in the interpretation.

Finally, inadequate statistical power due to the modest sample size in the present study (N = 99) may have played a role in limiting the significance of some of the statistical comparisons conducted. A post hoc power analysis revealed a low power value of 15% for the first hypothesis, medium power value of 67% for the second hypothesis, and a low power value of 24% for the third hypothesis (O’Keefe, 2007).

**Implications**

The World Health Organisation (2018) has recently released draft information on the 11th Revision of the International Classification of Diseases (ICD-11), and the decision on the inclusion of *gaming disorder*, which is characterized by “a pattern of persistent or recurrent gaming behaviour (‘digital gaming’ or ‘video-gaming’), which may be online (…) or offline” (WHO, 2018). The DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, fifth edition, 2013) includes *internet gaming disorder* in section 3 as a condition for further study. Giving the nature of video game engagement and the various elements involved from the moderate (eg. immersion and presence) to the more severe (eg. cognitive flow and
psychological absorption), there are implications for further research in this area. Future studies could examine other factors including time spent on play, and by isolating genre and platform, may provide a better understanding of user engagement in an increasingly popular past time for all ages and genders, whether played online or offline.

The present study examined video game engagement and mode of play, gender differences and approaches to problem-solving. It was found that there are no significant differences in engagement levels across single players and multiplayers, and males and females. Additionally, no significant differences were found in approaches to problem-solving across single or multiplayers. Single player mode was revealed as the dominant preference, and there is an implication that game genre and platform preference, may be influential in engagement levels.


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Appendix

Appendix A: Game Engagement Questionnaire (GEQ)

**Game Engagement Questionnaire (GEQ) items.**
The following questions relate to your subjective experiences during video game play. Please choose the appropriate response – Never (1), Rarely (2), Occasionally (3), Frequently (4), Very Frequently (5). Please note that there are no right or wrong answers.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Never</th>
<th>Rarely</th>
<th>Occasionally</th>
<th>Frequently</th>
<th>Very Frequently</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I lose track of time</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Things seem to happen automatically</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>I feel different</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>I feel scared</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>The game feels real</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>If someone talks to me, I don’t hear them</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>I get wound up</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Time seems to kind of stand still or stop</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>I feel spaced out</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>I don’t answer when someone talks to me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>I can’t tell that I’m getting tired</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>Playing seems automatic</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>My thoughts go fast</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>I lose track of where I am</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>I play without thinking about how to play</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>Playing makes me feel calm</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17</td>
<td>I play longer than I meant to</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18</td>
<td>I really get into the game</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19</td>
<td>I feel like I just can’t stop playing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
**Appendix B: The Independent-Interdependent Problem Solving Scale (IIPSS version 2)**

The following statements refer to your general approach to real-life problem solving. Please choose the appropriate response for each statement indicating how much you agree or disagree with that statement.

<table>
<thead>
<tr>
<th></th>
<th>“Strongly Agree”</th>
<th>“Agree”</th>
<th>“Partially Agree”</th>
<th>“Neutral”</th>
<th>“Partially Disagree”</th>
<th>“Disagree”</th>
<th>“Strongly Disagree”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>When faced with a difficult personal problem, it is better to decide yourself rather than to follow the advice of others.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I value other people’s help and advice when making important decisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>In general, I do not like to ask other people to help me to solve problems.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I prefer to make decisions on my own, rather than with other people.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I like to get advice from my friends and family when deciding how to solve my personal problems.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I prefer to consult with others before making important decisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I usually find other people’s advice to be the most helpful source of information for solving my problems.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I would rather struggle through a personal problem by myself than discuss it with a friend.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>I do not like to depend on other people to help me to solve my problems.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I usually prefer to ask other people for help rather than to try to solve problems on my own.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: Complete Engagement in Video Games Survey

Engagement in Video Gaming Survey

My name is Tracy Dorgan, and I am a psychology undergraduate at Dublin Business School. I am conducting research on the psychological aspects of video game engagement; the social facets, gender, and the approaches to problem-solving. This research is being conducted as part of my studies, and will be submitted for examination. You are invited to take part in the study which involves completing this online survey. As participation is anonymous and confidential, the collected responses will not be attributed to any individual participant.

Participation is voluntary, and you are not obliged to take part. The collected data from the survey will be securely stored in electronic format in a password protected computer, with limited access to the data. It is important to understand that completion and submission of this survey denotes consent to participate.

If you require any further information on this study, please contact me, Tracy Dorgan, at

Thank you for your participation.

1. I am over 18 and agree to participate in this study *
   Mark only one oval.
   
   [ ] Yes
   
   [ ] No  Stop filling out this form.

2. What sex are you? *
   Mark only one oval.
   
   [ ] Male
   
   [ ] Female
   
   [ ] Other

3. What age are you? *

Gaming Habits Questions
This section examines gaming habits. Please read each question and select the option(s) that applies to you.

4. What current generation platforms do you play video games on? (Tick all that apply) *
   Check all that apply.
   
   [ ] PC
   
   [ ] Xbox
   
   [ ] Nintendo
   
   [ ] PlayStation
   
   [ ] Mobile Devices
   
   [ ] Other:

https://docs.google.com/forms/d/1LhAxxy5kzuZWDXvysL02zcs9Zza1ZC9nAdPtbw79kzwOko/edit
1/7
5. How many hours in a typical day do you play video games, either online or offline? *
Mark only one oval.
- Less than one hour
- 1-2 hours
- 2-3 hours
- 3-4 hours
- 4-5 hours
- 5-6 hours
- + 6 hours
- Other: __________________________

6. What would you consider to be your favourite video game genre? (Please select one) *
Check all that apply:
- Massively Multiplayer Online (MMO)
- Simulations
- Adventure
- Real-Time Strategy (RTS)
- Puzzle
- Action
- Stealth Shooter
- Combat
- First or Third Person Shooters (FPS/TPS)
- Sports
- Role Playing (RPG)
- Educational
- Other

7. In general, do you prefer to play single player (offline) mode? *
Mark only one oval.
- Yes
- No

8. If your preferred mode is multiplayer, what is your social online play style? *
Mark only one oval.
- In private, with friends or family
- In public servers with people I don't know
- I do not play enough online to answer
9. When playing online multiplayer, do you usually use a headset/microphone, or text to communicate with other players? *
   Mark only one oval.
   - Yes, I use it to communicate when playing with people I know
   - Yes, I use it to communicate when playing with people I don’t know
   - I do not use a headset/microphone or text when playing online
   - I do not play multiplayer games

Game Engagement Questionnaire
The following questions relate to your subjective experiences during video game play. Please choose the appropriate response for each statement:
Never (1), Rarely (2), Occasionally (3), Frequently (4), Very Frequently (5).
Please note that there are no right or wrong answers.

10. 1. I lose track of time *
    Mark only one oval.

   1  2  3  4  5

   Never  Very Frequently

11. 2. Things seem to happen automatically *
    Mark only one oval.

   1  2  3  4  5

   Never  Very Frequently

12. 3. I feel different *
    Mark only one oval.

   1  2  3  4  5

   Never  Very Frequently

13. 4. I feel scared *
    Mark only one oval.

   1  2  3  4  5

   Never  Very Frequently

14. 5. The game feels real *
    Mark only one oval.

   1  2  3  4  5

   Never  Very Frequently
15. 6. If someone talks to me, I don’t hear them *
   Mark only one oval.

   1  2  3  4  5
   Never  Never  Never  Never  Very frequently

16. 7. I get wound up *
   Mark only one oval.

   1  2  3  4  5
   Never  Never  Never  Never  Very frequently

17. 8. Time seems to kind of stand still or stop *
   Mark only one oval.

   1  2  3  4  5
   Never  Never  Never  Never  Very frequently

18. 9. I feel spaced out *
   Mark only one oval.

   1  2  3  4  5
   Never  Never  Never  Never  Very frequently

19. 10. I don’t answer when someone talks to me *
   Mark only one oval.

   1  2  3  4  5
   Never  Never  Never  Never  Very frequently

20. 11. I can’t tell that I’m getting tired *
   Mark only one oval.

   1  2  3  4  5
   Never  Never  Never  Never  Very frequently

21. 12. Playing seems automatic *
   Mark only one oval.

   1  2  3  4  5
   Never  Never  Never  Never  Very frequently
22. 13. My thoughts go fast *
   Mark only one oval.

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23. 14. I lose track of where I am *
   Mark only one oval.

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24. 15. I play without thinking about how to play *
   Mark only one oval.

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25. 16. Playing makes me feel calm *
   Mark only one oval.

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26. 17. I play longer than I meant to *
   Mark only one oval.

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27. 18. I really get into the game *
   Mark only one oval.

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28. 19. I feel like I can’t stop playing *
   Mark only one oval.

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**Approach to problem-solving**

The following statements refer to your general approach to real-life problem solving. Please choose the appropriate response for each statement indicating how much you agree or disagree with that statement.
1 = Strongly Agree, 2 = Agree, 3 = Partially Agree, 4 = Neutral, 5 = Partially Disagree, 6 = Disagree, 7 = Strongly Disagree.

Please note that there are no right or wrong answers.

29. 1. When faced with a difficult personal problem, it is better to decide yourself than to follow the advice of others *

   Mark only one oval.

   1  2  3  4  5  6  7
   Strongly agree  ☐  ☐  ☐  ☐  ☐  ☐  ☐ Strongly disagree

30. 2. I value other people’s help an advice when making important decisions *

   Mark only one oval.

   1  2  3  4  5  6  7
   Strongly agree  ☐  ☐  ☐  ☐  ☐  ☐  ☐ Strongly disagree

31. 3. In general, I do not like to ask other people to help me to solve problems *

   Mark only one oval.

   1  2  3  4  5  6  7
   Strongly agree  ☐  ☐  ☐  ☐  ☐  ☐  ☐ Strongly disagree

32. 4. I prefer to make decisions on my own, rather than with other people *

   Mark only one oval.

   1  2  3  4  5  6  7
   Strongly agree  ☐  ☐  ☐  ☐  ☐  ☐  ☐ Strongly disagree

33. 5. I like to get advice from my friends and family when deciding how to solve my personal problems *

   Mark only one oval.

   1  2  3  4  5  6  7
   Strongly agree  ☐  ☐  ☐  ☐  ☐  ☐  ☐ Strongly disagree

34. 6. I prefer to consult with others before making important decisions *

   Mark only one oval.

   1  2  3  4  5  6  7
   Strongly agree  ☐  ☐  ☐  ☐  ☐  ☐  ☐ Strongly disagree
35. I usually find other people's advice to be the most helpful source of information for solving my problems *
   Mark only one oval.

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36. I would rather struggle through a personal problem by myself than discuss it with a friend *
   Mark only one oval.

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37. I do not like to depend on other people to help me solve my problems *
   Mark only one oval.

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38. I usually prefer to ask other people for help rather than to try to solve problems on my own *
   Mark only one oval.

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Thank you
Please press the SUBMIT button below.

Your responses will be recorded. Thank you for taking the time to participate in this study.
If you feel that by answering this survey, it has raised some issues for you, please consider speaking
to a friend, family member or professional. Alternatively, you can contact the support service below.

Rutland Centre
Video Game Addiction
Support line (24 hr): 01 4946358
Web address: https://www.rutlandcentre.ie/what-we-treat/gaming

If you should have any queries regarding the survey, please contact me at [redacted]
Appendix D: Histograms showing the distribution of engagement scores for single players and multiplayers.
Appendix E: Histograms showing the distribution of engagement scores for males and females.
Appendix F: Histograms showing the distribution of independent approach to problem-solving scores for single and multiplayers.

Histogram

Single player independent problem-solving

- Mean = 35.18
- Std. Dev. = 9.236
- N = 73

Histogram

Multiplayer independent problem-solving

- Mean = 32.39
- Std. Dev. = 11.382
- N = 26