

# University Students' Video Gaming: Reasons, Preferences, and Behavioural Effects

Kian Millamena<sup>1</sup>, Nicolei Panlilio<sup>2</sup> and Alvin C. M. Kwan<sup>3</sup>

<sup>1</sup>Technology and Digital, Hong Kong Disneyland, Hong Kong

<sup>2</sup>Business Development, KG Group Education, Hong Kong

<sup>3</sup>Faculty of Education, The University of Hong Kong, Hong Kong

[cmkwan@hku.hk](mailto:cmkwan@hku.hk)

**Abstract:** Research on players' reasons for video gaming, their video game preferences, and the behavioural effects of video gaming on the players tends to study those issues separately. This study attempts to explore all those issues collectively with the aim of facilitating game designers to develop appealing educational games for university students without inflicting negative behavioural impacts on the students. Relevant data from 100 undergraduates were collected from an online survey. Cluster analysis of the eight major reasons for playing video games resulted in grouping the respondents into five clusters. The cluster that rated *peer effect* as the major reason for playing is male-dominated whereas the cluster that rated *family influence* as the major reason is female-dominated. A similar analysis of the respondents' video game genre preferences reveals that the cluster favouring fighting and battle games is male-dominated, whereas the cluster favouring family entertainment games is female-dominated. Both genders enjoy playing challenging adventure-strategy games. Most respondents perceived that their cognitive functioning had improved through video gaming, but no conclusion can be drawn as to whether video gaming can improve their social and psychological functioning. Except for poor sleeping habits, most respondents had not experienced any significant negative effects from playing video games. No statistical evidence supports that playing violent video games would induce aggressive behaviours. As games that involve a high demand for players' motor skills may not be a good choice for educational games and violent games may induce poor sleep quality, it is concluded that challenging adventure games and strategy games are suitable educational game genres for undergraduate students.

**Keywords:** Video gaming motivation, Video gaming effects, Video game preference

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## 1. Introduction

The number of active video gamers reached 2.81 billion globally. The number is predicted to exceed the 3-billion mark in the next two years (Clement, 2022). The increasing popularity of video games has seen young adult gamers play up to 7 to 12 hours per week (Limelight Networks Inc., 2020). Modern video games boast many game elements, including but not limited to destruction, excitement, community, challenge, strategy, completion, power, fantasy, story, design, and discovery (Quantic Foundry LLC., 2016). Some popular video game genres are casual single-player games such as *Candy Crush*, first-person shooter (FPS) games such as *Call of Duty*, battle royale (BR) games such as *Fortnite*, multiplayer online battle arena (MOBA) games such as *League of Legends*, and massively multiplayer online role-playing (MMORPG) games such as *World of Warcraft*.

Gamers play video games for various reasons, ranging from developing online relationships in the virtual world to distracting themselves from everyday hassles (Von der Heiden et al., 2019). The debate over the pros and cons of video gaming has been going on for decades. There are frequent discussions on the connection between video games and violence, particularly after one of the killers in the 1999 Columbine High School massacre was found to have a history of playing a shooting video game. While Holtz and Appel (2011), and Quwaider et al. (2019) suggested that video gaming might be related to behavioural problems in children and adolescents such as misconduct and depression, Warnick (2019) however pointed out that the research findings of neither University of Oxford nor Harvard University show any significant link between video game playing and aggressive behaviour or depression.

This research aims to study undergraduate students' motivational reasons contributing to video game playing, analyse their video game preferences, and the impacts of video gaming on them.

The research questions are as follows:

- RQ1: What are the reasons for university students playing video games?
- RQ2: What types of video games do university students prefer to play?
- RQ3: What are the impacts of video gaming on the behaviours of university students?

To answer the research questions, potential answers to the questions were obtained from the literature for the creation of a relevant online survey for undergraduate students to participate in. For RQ3, the General Affective Aggression Model (GAM) was considered for developing questions about whether playing violent video games may induce aggression (Allen and Anderson, 2017).

Knowing the answers to the above questions can help instructional designers and game designers create engaging educational games without any significant negative effects on university students.

## **2. Related Literature**

### **2.1 Reasons for video gaming**

Li et al. (2011) suggested that many adolescents are “avoiding real-life problems by engaging in media such as TV and video games”. They further explained that the game players regard escapism as a means of managing personal mood. Kline and Arlidge (2003) reported that many gamers play online video games for social connections as they are able to meet old friends and make new friends by joining a clan in the games. Ferguson and Olson (2013) stated that young people play video games mainly because of social motives, catharsis motivations, and the search for challenges. Video games also include elements of imagination and fantasy. Molesworth (2009) found that escapism is highly linked to the desire of being in another environment in a phenomenological study. This is especially true for imaginative and fantasy game playing.

### **2.2 Impacts of video gaming on gamers’ behaviours**

#### *2.2.1 Positive behavioural effects*

Some video gaming, especially for playing FPS games, was observed to enhance cognitive functioning skills. Players were found to display faster attention allocation of higher accuracy and enhanced spatial resolution in visual processing (Bavelier et al., 2011). Such cognitive enhancements were not achievable by playing puzzle or role-playing games.

Some studies suggested that video game playing enhances problem-solving skills and working memory. In particular, complex puzzles and action sequences require memorisation and analytical skills (Prensky, 2012). Adachi and Willoughby (2013) found that adolescents who played role-playing games had their problem-solving skills improved, which were evident up to one year later. The research further suggests that more strategic video gameplay contributes to higher self-reported problem-solving skills over time which in turn helps adolescents attain better academic grades than less strategic video gameplay.

Video game playing is believed to generate positive psychological changes and provided players with positive moods. Casual puzzle video games, such as *Angry Birds* and *Bejeweled II*, were found to improve moods, promote relaxation, and ease anxiety. Players' mental stress and depression levels decreased significantly (Russoniello, O'Brien and Parks, 2009). Granic, Lobel and Engels (2014) reported that video game players often attain intense pride experienced after gaining success against great adversity.

Video games that required cooperation enhance social skills and prosocial behaviour (Gentile et al., 2009). Players often need to plan and make informed decisions on whether to trust or reject other players and learn how to lead groups effectively in virtual worlds. While many people believe that playing violent video games would make the players more hostile, Schmierbach (2010) found that when played cooperatively, violent video games in fact lower player engagement in aggressive behaviours.

#### *2.2.2 Negative behavioural effects*

Clinical distress and impairment in sleeping habits were reported to be associated with Internet gaming disorder (IGD) in (Altintas et al., 2019). Results indicated that over half the research participants reported poor sleep quality. Higuchi et al. (2005) investigated the effects of video game playing late in the night on sleeping quality for young male adults. Disturbances in sleep latency, slow-wave sleep, and rapid eye movement (REM) sleep were labelled psychological symptoms of IGD. Their results suggest that playing an exciting computer game affects sleep latency and REM sleep.

Mihara and Higuchi (2017) reported that psychological and mental distress symptoms, such as depression, anxiety, and social phobia were observed in youth who pathologically played video games. Caplan (2007)

investigated relationships between social anxiety, loneliness, and interactive online game playing. Despite feeling lonely, players preferred virtual worlds to avoid experiencing social anxiety and interpersonal problems by escaping the social world. Anderson et al. (2010) suggested that repeated exposure to violent video games leads to decreased empathy and prosocial behaviour, and significantly increases aggressive thoughts, behaviour, and hostility. Fast-paced and challenging games stimulate aggressive thoughts, and increase frustration and anger. Lo, Wang and Fang (2005) studied the effects of video games on interpersonal relationships and social anxiety levels. Their results show that interpersonal relationship quality decreased when the amount of social anxiety in heavy video game players increased. Goh et al. (2019) indicated that players had lower self-esteem and poorer psychological well-being after playing a game called *DOTA 2*. Adachi and Willoughby (2016) corroborated that competitive play increases aggressive effects in players.

To facilitate game designers to develop engaging educational games for university students without inflicting negative behavioural impacts on the students, the designers need to consider players' reasons for video gaming, the players' video game preferences, and the potential behavioural effects of video gaming on the players together. Unfortunately, past research tends to study those issues separately. This study attempts to explore all those issues collectively to identify video game genres and elements that are suitable for educational game development for undergraduates.

### **3. Research Design**

#### **3.1 Research methods**

A quantitative approach was adopted. The target subjects were undergraduate students in Hong Kong. Other types of university students such as postgraduate and research students were excluded from this study as their demographic variables would be much more diverse when compared to the undergraduate students.

##### *3.1.1 Data collection*

An online survey with questions about the participants' demographics such as age, gender, and year of study, relevance of various reasons such as environmental and social factors that influence video game playing with answers in a Likert scale of 1 ("least likely") to 5 ("most likely"), video game preferences by genre in a Likert scale of 1 ("least favourite") to 5 ("most favourite"), and the behavioural impacts of video gaming on cognitive functioning, social functioning, psychological functioning including aggression and hostility (in yes-no format) was designed by referencing the literature (Whitbourne, Ellenberg and Akimoto, 2013; Yee 2006; Quick, Atkinson and Lin 2012). General Affective Aggression Model (GAM) was adopted to examine whether playing violent video games may induce aggression (Allen and Anderson, 2017). The survey questionnaire can be found at <https://tinyurl.com/4jcxp58u>. Invitations were sent to target subjects through various electronic means and 100 valid responses including 55 from male students and 45 from female students were received. The mean and standard deviation of the respondents' age distribution are 20.84 and 1.22 respectively.

##### *3.1.2 Data analysis*

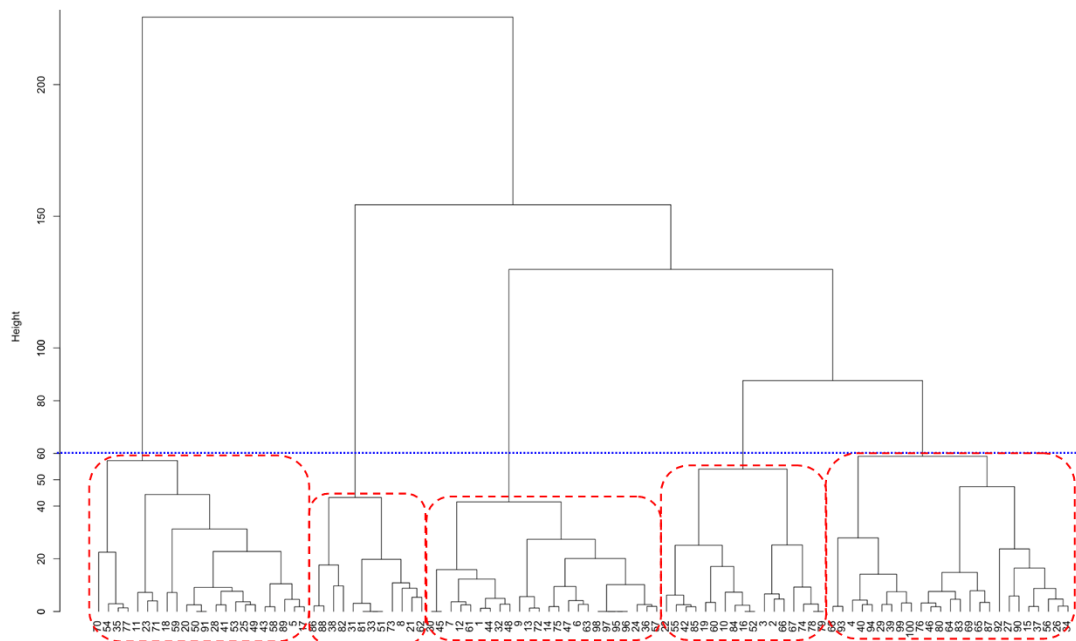
While each student has his/her own video game playing reasons and game genre preferences, it is believed that students' choices tend to form clusters. For example, students who like playing shooting games are likely love playing fighting games but less interested in adventure and strategy games, and vice versa. Thus, hierarchical clustering (Everitt, 2011) was used for analysing video game playing reasons and game genre preferences. Sum of squares of Euclidean distances was used as a measure of dissimilarity in the clustering process. Based on the respondents' rating data of video game playing reasons (or preferences based on genre), the respondents were classified to different clusters hierarchically with the use of Ward's minimum variance method after z-score transformation. Then the cluster means of the concerning variables were examined for investigating the characteristics of each cluster. The behavioural impacts of video game playing on respondents were also studied for each of the revealed clusters when studying video game playing preferences. The potential gender effect within each cluster was also studied. Data analyses were done with R and SPSS.

### **4. Results**

#### **4.1 Video game playing reasons**

Based on the respondents' rating of eight video game playing reasons including looking for a challenge, emotional satisfaction, peer pressure/effect, family influence, escapism, social connections, engaging in imaginative and fantasy play, and video game marketing, the mean score (ms) for each game play reason was

computed. The top game playing reasons are emotional satisfaction (ms = 3.54), looking for a challenge (ms = 3.45), escapism (ms = 3.41), and engaging in imaginative and fantasy play (ms = 3.37). Based on the input from individual respondents, the following cluster dendrogram is developed.



**Figure 1:** Cluster dendrogram for video game player reasons

The labels at the bottom of Figure 1 are the respondent number whereas the height at which two respondents (or clusters of respondents) are joined together reflects their degree of similarity (or the distance between the joined clusters). A smaller height implies a higher degree of similarity of the joined respondents in the concerned cluster. When the threshold of the height is set to 60, five clusters are formed. Further grouping of the clusters will result in a relatively large increase in the height. The means of the video game playing reasons of each of the five clusters are summarised in Table 1.

**Table 1:** Group means of the video game playing reasons of each cluster

cluster	Challenge	Emotion	PPressure	Family	Escapism	Socialise	Engagement	Marketing
1	0.168	0.81	-0.62	-0.18	0.5637	-0.34	0.665	-0.36
2	0.051	0.33	0.63	-0.42	-0.3649	-0.26	-0.966	0.20
3	0.625	-0.23	0.46	-0.37	0.0081	0.71	0.562	0.69
4	-0.792	-0.98	-0.64	-0.25	-0.6496	-0.64	-0.634	-0.85
5	-0.260	0.18	0.56	2.18	0.5637	0.75	0.029	0.55

**Table 2:** Gender distribution of respondents in clusters of video game playing reasons

cluster	Female	Male
1	0.54166667	0.45833333
2	0.47058824	0.52941176
3	0.28000000	0.72000000
4	0.27272727	0.72727273
5	0.91666667	0.08333333

The top two reasons for video game playing of respondents in cluster 1 are Emotion and Engagement. These individuals craved *emotional satisfaction* (0.81), followed by a desire to *engage in imaginative and fantasy play* (0.665). Those in cluster 2 played video games mainly because of *peer pressure/effect* (0.63) and craved *emotional satisfaction* (0.33). Respondents in cluster 3 considered *online social connections* (0.71) and were swayed by *video game marketing* (0.69). No clear reasons can be identified to account for why respondents in cluster 4 played video games. Those in cluster 5 rated *family influence* (2.18) and *social connections* (0.75) as their most preferred reasons for playing. For ease of reference, clusters 1, 2, 3, 4, and 5 are labelled by “emotion-

oriented”, “peer-oriented”, “socially oriented”, “inexplicable” and “family-oriented” and associated with 24%, 17%, 25%, 22% and 12% of the respondents respectively. When examining the gender distribution of respondents in the clusters (see Table 2), the “socially oriented” and “inexplicable” are found to be male-dominated whereas the “family-oriented” cluster is female-dominated.

#### 4.2 Video game genre preferences

The mean score (ms) for each video game genre preference was computed. The most favourite genres are “Adventure” (ms = 4.04), “Strategy” (ms = 3.61), “Racing” (ms = 3.47), and “Fighting” (ms = 3.41) games. However, female respondents are slightly less enthusiastic in “Racing” games when compared to the male respondents in one-tailed Mann-Whitney U Test ( $n = 100, p = 0.05, r = 0.13$ ). Hierarchical clustering was again used to study the respondents’ preferences for 10 video game genres including *MMORPG, MOBA, FPS, BR, fighting, family entertainment, strategy, sports, adventure, and racing*. By applying the elbow method, it was decided to classify the respondents to four clusters. Cluster 1 has the highest number of respondents at 44, followed by cluster 2 at 28. Cluster 3 has the lowest out of the clusters at 11, while cluster 4 has 17 respondents.

**Table 3:** Group means of the video game genre preferences of each cluster

cluster	MMORPG	MOBA	FPS	BR	Fighting	FE	Strategy	Sports	Adventure	Racing
1	0.23	0.037	-0.043	-0.182	-0.036	-0.025	0.259	0.014	0.39	-0.273
2	0.45	0.657	0.841	1.010	0.786	-0.071	0.059	0.753	-0.12	0.679
3	-0.67	-0.422	0.011	0.015	-0.527	-0.733	-1.553	-1.053	-1.57	-0.777
4	-0.92	-0.906	-1.282	-1.202	-0.861	0.655	0.236	-0.595	0.21	0.091

**Table 4:** Gender distribution of respondents in clusters of video game genre preferences

cluster	Female	Male
1	0.5227273	0.4772727
2	0.2142857	0.7857143
3	0.4545455	0.5454545
4	0.6470588	0.3529412

As shown in Table 3, respondents in cluster 1 prefer playing “Adventure” (0.39), “Strategy” (0.259) and “MMORPG” (0.23) games, and are less interested in battling (“BR”), fighting and racing games. The cluster shares a similar proportion of female (52.3%) and male (47.7%) students (see Table 4). Cluster 2 is mainly composed of male respondents (~79%). Respondents in the cluster 2 rated “BR”, “FPS”, and “Fighting” genres with high values at 1.01, 0.841 and 0.786 respectively. They were interested in “MOBA” (0.657), “Sports” (0.753) and “Racing” (0.679) but not keen on “FE” (-0.071), “Strategy” (0.0529) and “Adventure” (-0.12) games. These suggest that the respondents in cluster 2 may favour action games. Cluster 3, which has a similar number of male and female students in it, does not seem to associate with any video game genre preference clearly. The respondents in the cluster gave low positive ratings to “FPS” (0.011) and “BR” (0.015) and negative ratings to all remaining genres, indicating that they do not have a clear game genre preference when compared to respondents of other clusters. Respondents in cluster 4 ranked “FE” (0.655), “Strategy” (0.236), and “Adventure” (0.21) genres the highest and rated “FPS” and “BR” genres with rather low values. While the respondents in both clusters 1 and 4 are not keen on battling, fighting and racing games, a key difference between the clusters is that family entertainment (“FE”) is not a favourite game genre in cluster 1 but a preferred genre in cluster 4. Both clusters 1 and 4 are gender-neutral statistically even though cluster 4 has more female respondents in it (64.7%).

#### 4.3 Perceived behavioural impacts

With the use of a list of yes-no questions (0: No; 1: Yes) in the online survey, the perceived behavioural effects to video games players were collected. Those effects are related to the cognitive, social, and psychological functioning of the players. Statistical analysis of the effects on video games players in each of the aforesaid four video game genre preferences clusters was conducted.

##### 4.3.1 Cognitive functioning

The respondents opined that their cognitive functioning in seven aspects (see the underlined entries in Figure 2) had been improved through video gaming. The results of a more refined analysis of whether significant improvements are found in each of the seven aspects in each cluster are shown in Figure 2.

<u>Enhanced Concentration</u>		<u>Enhanced Hand-eye Coordination</u>		<u>Enhanced Working Memory</u>		<u>Enhanced Spatial Navigation</u>		
cluster	0	1	cluster	0	1	cluster	0	1
1	0.06818182	0.93181818	1	0.06818182	0.93181818	1	0.15909091	0.8409091
2	0.03571429	0.96428571	2	0.00000000	1.00000000	2	0.2142857	0.7857143
3	0.18181818	0.81818182	3	0.00000000	1.00000000	3	0.2727273	0.7272727
4	0.11764706	0.88235294	4	0.17647059	0.82352941	4	0.2352941	0.7647059

<u>Increased Processing Speed (Reaction Time)</u>		<u>Improved Problem-Solving</u>		<u>Higher Levels of Logical Thinking</u>	
cluster	0	1	cluster	0	1
1	0.02272727	0.97727273	1	0.1136364	0.8863636
2	0.03571429	0.96428571	2	0.1785714	0.8214286
3	0.09090909	0.90909091	3	0.3636364	0.6363636
4	0.17647059	0.82352941	4	0.2352941	0.7647059

**Figure 2:** Proportion of respondents experienced improvement in various types of cognitive functioning (0: No; 1: Yes) in video game genre preferences clusters

The results of Chi-square test for goodness of fit show that out of the 28 cases (which correspond to the seven aspects of cognitive functioning in each of the four clusters), significant differences were found in 24 cases. The four exceptions which are highlighted in Figure 2 may be related to the small size of cluster 3 ( $n = 11$ ). Similar analysis results based on the entire sample ( $n = 100$ ) show that improvements are found in all the seven aspects of cognitive functioning.

#### 4.3.2 Social and psychological functioning

Once again, Chi-square test for goodness of fit was applied to study whether any improvement in seven types of social and psychological functioning was observed by the respondents in each of the clusters created according to respondents' preferred video game genres. Significant results are highlighted in Figure 3. Out of the 28 cases, significant improvements were found in 11 cases. Those improvements are mainly related to improved strategic planning, improved team collaboration, and relief of stress. When the analysis is done on the entire sample, statically significant results are found in improved strategic planning, improved team collaboration, relief of stress, and relief of anxiety.

<u>Enhanced Emotional Awareness</u>		<u>Improved Relationships</u>		<u>Improved Strategic Planning</u>		<u>Improved Social Skills</u>		
cluster	0	1	cluster	0	1	cluster	0	1
1	0.4318182	0.5681818	1	0.5681818	0.4318182	1	0.09090909	0.90909091
2	0.5714286	0.4285714	2	0.5714286	0.4285714	2	0.10714286	0.89285714
3	0.8181818	0.1818182	3	0.6363636	0.3636364	3	0.27272727	0.72727273
4	0.4117647	0.5882353	4	0.4117647	0.5882353	4	0.05882353	0.94117647

<u>Improved Team Collaboration</u>		<u>Ease Stress</u>		<u>Ease Anxiety</u>	
cluster	0	1	cluster	0	1
1	0.13636364	0.86363636	1	0.09090909	0.90909091
2	0.03571429	0.96428571	2	0.21428571	0.78571429
3	0.27272727	0.72727273	3	0.18181818	0.81818182
4	0.17647059	0.82352941	4	0.47058824	0.52941176

**Figure 3:** Proportion of respondents experienced improvement in various types of social and psychological functioning (0: No; 1: Yes) in video game genre preferences clusters

#### 4.3.3 Negative impacts

The survey includes questions about whether the respondents have been negatively impacted after playing video games. Such impacts include low self-esteem, poor sleeping habits, gaming addiction/disorders, relationship problems, social disconnection, lack of motivation, and poor academic performance. Collected data were analysed by Chi-square test. The results show that the respondents do not see video game playing entail negative effects in general. The only exception is that a significant proportion of respondents in clusters 1 and 2 suffered from poor sleeping habits as highlighted in Figure 4.

<u>Low Self-esteem</u>			<u>Poor Sleeping Habits</u>			<u>Gaming Addiction/Disorders</u>			<u>Relationship Issues</u>		
cluster	0	1	cluster	0	1	cluster	0	1	cluster	0	1
1	0.90909091	0.09090909	1	0.2954545	0.7045455	1	0.6363636	0.3636364	1	0.86363636	0.13636364
2	0.92857143	0.07142857	2	0.2500000	0.7500000	2	0.6428571	0.3571429	2	0.89285714	0.10714286
3	0.63636364	0.36363636	3	0.4545455	0.5454545	3	0.7272727	0.2727273	3	0.81818182	0.18181818
4	0.64705882	0.35294118	4	0.5294118	0.4705882	4	0.8235294	0.1764706	4	0.94117647	0.05882353

<u>Social Disconnection/Withdrawal</u>			<u>Lack of Interest/Motivation</u>			<u>Poor Academic Performance</u>		
cluster	0	1	cluster	0	1	cluster	0	1
1	0.6590909	0.3409091	1	0.4318182	0.5681818	1	0.77272727	0.22727273
2	0.6785714	0.3214286	2	0.6785714	0.3214286	2	0.82142857	0.17857143
3	0.8181818	0.1818182	3	0.6363636	0.3636364	3	0.72727273	0.27272727
4	0.8823529	0.1176471	4	0.8235294	0.1764706	4	0.94117647	0.05882353

**Figure 4:** Proportion of respondents experienced negative impacts in various types of cognitive, social, and psychological functioning (0: No; 1: Yes) in video game genre preferences clusters

Regarding aggression and hostility, there is no statistically proven evidence that the respondents experienced aggression and hostility after video game playing for individual clusters (see Figure 5), or for the entire sample.

<u>Violent Thoughts</u>			<u>Irritability/Restlessness</u>			<u>Elevated Blood Pressure</u>			<u>Confrontational Behaviour</u>		
cluster	0	1	cluster	0	1	cluster	0	1	cluster	0	1
1	0.7727273	0.2272727	1	0.5909091	0.4090909	1	0.7727273	0.2272727	1	0.7500000	0.2500000
2	0.8214286	0.1785714	2	0.4642857	0.5357143	2	0.4285714	0.5714286	2	0.6071429	0.3928571
3	0.6363636	0.3636364	3	0.7272727	0.2727273	3	0.7272727	0.2727273	3	0.6363636	0.3636364
4	0.7647059	0.2352941	4	0.5294118	0.4705882	4	0.5294118	0.4705882	4	0.8823529	0.1176471

<u>Excessively Competitive Thoughts</u>			<u>Verbal Hostility</u>			<u>Destruction of Property</u>		
cluster	0	1	cluster	0	1	cluster	0	1
1	0.5000000	0.5000000	1	0.6136364	0.3863636	1	0.95454545	0.04545455
2	0.5714286	0.4285714	2	0.3928571	0.6071429	2	0.78571429	0.21428571
3	0.3636364	0.6363636	3	0.6363636	0.3636364	3	0.81818182	0.18181818
4	0.5294118	0.4705882	4	0.7058824	0.2941176	4	1.00000000	0.00000000

**Figure 5:** Proportion of respondents experienced aggression and hostility (0: No; 1: Yes) in video game genre preferences clusters

## 5. Discussions

### 5.1 Game playing reason clusters and associated game genres

Among the five clusters of respondents identified by applying hierarchical clustering on reasons of playing video games, about half of the respondents are grouped into the “socially oriented” and “emotion-oriented” clusters. The following discussions will focus on the two clusters only, ignoring the “inexplicable” cluster and the remaining two relatively small clusters.

#### 5.1.1 “Social oriented” cluster

The “socially oriented” cluster is male-dominated. It has 18 male and 7 female respondents. This does not mean that the male respondents gave a significantly larger weight to social connection than the female respondents. An analysis with the use of the Mann-Whitney U test shows no gender difference in the drive for making social connections in game playing for the entire sample. Anyhow, online collaboration and community challenges are possible means to facilitate social connection. The second important video game playing reason of the cluster is whether the potential players would play a video game due to its marketing efforts. Once again, no gender difference can be found for the game playing reason. In the context of educational settings, on top of rewarding students with game points in game playing, teachers may consider rewarding students by converting game points to bonus scores for assessment tasks to promote a video game to the students. Verbal praises and encouragement from teachers will also be helpful. Looking for challenges is the third important motivator associated with the cluster. The male respondents gave the motivator a larger weight than the female respondents ( $n = 100$ ;  $p = 0.02$ ;  $r = 0.23$ ) but the difference is rather small. Relevant game elements are leader board and game levels.

In brief, educational video games for students belonging to the “socially oriented” cluster should aim to facilitate social connection, offer adequate challenges, and provide extrinsic motivators to engage their players. Since the group is male-dominated and the male respondents tend to favour adventure, strategy, first-person shooting, and racing games in descending order of preference, the aforesaid game genres appear to be reasonable choices for students classified into the cluster. However, games that involve a high demand for players’ motor skills may not be a good choice for educational games as the game scores may not be able to adequately reflect a player’s achievement of the learning goals (Yip and Kwan, 2006). Thus, adventure games and strategy games seem to be suitable educational game genres for students in the cluster in general.

#### *5.1.2 “Emotion-oriented” cluster*

The gender distribution of respondents in the “emotion-oriented” cluster is quite even, with the number of female students in the cluster slightly more than that of male students. In fact, the male and female respondents rated achieving emotional satisfaction as the second important and the most important reason for playing video games respectively in the entire sample. For students classified in this cluster, fostering their emotional satisfaction must be a key game feature. As engaging students in fantasy/imaginative play is the second most important game playing reason of the cluster, an attractive game context for embedding the learning elements is important. The findings reported in (Lopez-Fernandez, et al., 2019) purport that females play video games for personal preoccupation which corresponds to satisfying emotional needs and engaging in fantasy/imaginative play in the current study. However, the results of applying the Mann-Whitney U test to the data of the current study revealed no significant differences between the male and female respondents in either the needs for emotional satisfaction or the desire in engaging in fantasy/imaginative play. Note that the target subjects of the research conducted by Lopez-Fernandez, et al. were confined to female gamers.

### **5.2 Behavioural effects**

Most respondents experienced positive effects in the seven cognitive functioning behaviours. These aligned with studies that suggested adventure games improved visual monitoring and accuracy. These occur when players scan environments for resources that help them progress through games (Zelinski and Reyes, 2009). MMORPGs enhance player response speeds and working memory when managing collected items or magic spells and memorizing enemy weaknesses.

As to social and psychological functioning, statistically proven improvements were found in the areas of strategic planning, team collaboration, relief of stress, and relief of anxiety when considering the entire sample. Past studies give similar results. *WoW*, an adventure-strategy MMORPG, allows players to experience emotions and practice team coordination skills, including social communication, group cooperation, and strategic planning pre-battle (Chang and Lin, 2014). Our results are also in line with Martončik and Lokša (2016), where *WoW* players used MMORPGs to reduce stress and experienced less social anxiety online than in real life.

Poor sleeping habits are the only negative impact of video game playing revealed by the current study. This finding concurs with Rusia and Gravoso’s (2009) findings that playing MMORPGs had negative impacts on players’ sleeping quality. According to Table 3, respondents from clusters 1 and 2 like playing MMORPG games. Respondents from cluster 2 particularly like playing violent games such as battling, fighting, and shooting games. Respondents in clusters 1 and 2 tend to have poor sleeping habits (see the highlighted part in Figure 5). The phenomenon can be accounted for by past research. Achab et al. (2011) reported high MMORPG addiction rates that linked to sleep deprivation with adult gamers who were mainly young adult university graduates whereas Ivarsson et al. (2013) found boys aged 13-16 years who played violent video games no more than an hour daily had lower sleep quality when compared to those who played non-violent video games.

No significant link between experienced aggression and hostility, and video game playing is found in the current study. This is consistent with the findings reported in (Warnick 2019).

## **6. Conclusion**

The reasons for video game playing and the video game preferences of undergraduate students in Hong Kong were investigated. The positive and negative impacts of video game playing on the subjects were studied too. The findings suggest that adventure and strategy games in an imaginative and fantasy context are preferred elements of educational video games for undergraduates in general. While challenges are an important reason for video game playing, the instructional designers and game designers need to ensure that those challenges can be coped with by average students as looking for emotional satisfaction in game playing is another important

reason for video game playing. Enabling learners to establish social connections with others in the game environment would be an added benefit.

The study has several limitations. First, the small sample size may hamper the validity of some of the analyses due to type II error. Second, some of the analyses based on the results displayed in Tables 2 and 4 may be biased toward males slightly as the sample has slightly more male than female respondents. Third, while some general recommendations on characteristics of educational video games for undergraduates can be made, it is worth noting that the game characteristics that learners classified into different clusters based on game-playing reasons look for are very different. Developing multiple educational video games for the same purposes to facilitate the learning of individual users may sound luxurious. However, for massive open online courses that involve potentially thousands and even tens of thousands of learners over time, developing “personalised” educational games for individual learners is still worth considering. The challenge is how to map a learner to the best-fit cluster effectively. Machine learning techniques for recommendation systems such as collaborative filtering can be a potential solution to the problem.

## References

- Achab, S., Nicolier, M., Mauny, F., Monnin, J., Trojak, B., Vandell, P., ... and Haffen, E. (2011). “Massively multiplayer online role-playing games: comparing characteristics of addict vs non-addict online recruited gamers in a French adult population”, *BMC psychiatry*, 11(1), 1-12.
- Adachi, P. J. C. and Willoughby, T. (2013). “More Than Just Fun and Games: The Longitudinal Relationships Between Strategic Video Games, Self-Reported Problem Solving Skills, and Academic Grades”, *Journal of Youth and Adolescence*, Vol. 42 No. 7, pp. 1041–1052.
- Adachi, P. J. C. and Willoughby, T. (2016). “The Longitudinal Association Between Competitive Video Game Play and Aggression Among Adolescents and Young Adults”, *Child Development*, Vol. 87 No. 6, pp. 1877-1892.
- Allen, J. J. and Anderson, C. A. (2017). “General Aggression Model”, in Roessler, P., Hoffner, C. A. and van Zoonen, L. (Eds.) *International Encyclopedia of Media Effects*. Wiley-Blackwell.
- Altintas, E., Karaca, Y., Hullaert, T. and Tassi, P. (2019). “Sleep quality and video game playing: Effect of intensity of video game playing and mental health”, *Psychiatry Research*, Vol. 273, pp. 487-492.
- Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., Rothstein, H. R. and Saleem, M. (2010). “Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries: A meta-analytic review”, *Psychological Bulletin*, Vol. 136 No. 2, pp. 151–173. <https://doi.org/10.1037/a0018251>
- Bavelier, D., Green, C., Han, D., Renshaw, P., Merzenich, M. and Gentile, D. (2011). “Brains on video games”, *Nature Reviews. Neuroscience*, Vol. 12, pp. 763–768. <https://doi.org/10.1038/nrn3135>
- Caplan, S. (2007). “Relations Among Loneliness, Social Anxiety, and Problematic Internet Use”, *Cyberpsychology and Behavior: The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society*, Vol. 10, pp. 234-242.
- Chang, S.-M. and Lin, S. S. J. (2014). “Team knowledge with motivation in a successful MMORPG game team: A case study”, *Computers and Education*, Vol. 73, pp. 129–140. <https://doi.org/10.1016/j.compedu.2013.09.024>
- Clement, J. (2021b, January 29). *Number of gamers worldwide 2015-2024*. Statista. Available at: <https://www.statista.com/statistics/748044/number-video-gamers-world/> (Assessed: 4 June 2022)
- Everitt, B. S. (2011). *Clustering Analysis (5<sup>th</sup> ed.)*, Wiley.
- Ferguson, C. J. and Olson, C. K. (2013). “Friends, fun, frustration and fantasy: Child motivations for video game play”, *Motivation and Emotion*, Vol. 37 No. 1, 154–164. <https://doi.org/10.1007/s11031-012-9284-7>
- Gentile, D., Anderson, C., Yukawa, S., Ihori, N., Saleem, M., Lim, K. M., Shibuya, A., Liau, A., Khoo, A., Bushman, B., Huesmann, L. and Sakamoto, A. (2009). “The Effects of Prosocial Video Games on Prosocial Behaviors: International Evidence From Correlational, Longitudinal, and Experimental Studies”, *Personality and Social Psychology Bulletin*, Vol. 35, pp. 752–763. <https://doi.org/10.1177/0146167209333045>
- Goh, C., Jones, C. and Copello, A. (2019). “A Further Test of the Impact of Online Gaming on Psychological Wellbeing and the Role of Play Motivations and Problematic Use”, *Psychiatric Quarterly*, Vol. 90 No. 4, pp. 747-760.
- Granic, I., Lobel, A. and Engels, R. C. M. E. (2014). The benefits of playing video games. *American Psychologist*, Vol. 69 No. 1, pp. 66–78. <https://doi.org/10.1037/a0034857>
- Higuchi, S., Motohashi, Y., Liu, Y. and Maeda, A. (2005). “Effects of playing a computer game using a bright display on presleep physiological variables, sleep latency, slow wave sleep and REM sleep”, *Journal of Sleep Research*, Vol. 14, pp. 267–273. <https://doi.org/10.1111/j.1365-2869.2005.00463.x>
- Holtz, P. and Appel, M. (2011). “Internet use and video gaming predict problem behavior in early adolescence”, *Journal of Adolescence*, Vol 34 No. 1, pp. 49–58.
- Ivarsson, M., Anderson, M., Åkerstedt, T. and Lindblad, F. (2013). “The effect of violent and nonviolent video games on heart rate variability, sleep, and emotions in adolescents with different violent gaming habits”, *Psychosomatic medicine*, Vol. 75 No. 4, pp. 390-396.
- Kline, S. and Arlidge, A. (2003). *Online Gaming as an emergent social media: a survey*. Available at: <http://www.sfu.ca/media-lab/onlinegaming/report.htm> (Assessed: 4 June 2022)

- Li, D., Liau, A. and Khoo, A. (2011). "Examining the Influence of Actual-Ideal Self-Discrepancies, Depression, and Escapism, on Pathological Gaming Among Massively Multiplayer Online Adolescent Gamers", *Cyberpsychology, Behavior, and Social Networking*, Vol. 14 No. 9, pp. 535-539.
- Limelight Networks Inc. (2020). *The State of Online Gaming – 2020 Research Report*. Available at: [https://img03.en25.com/Web/LLNW/%7Bd6493b33-3811-4b20-a410-64c25141adb4%7D\\_SOOG\\_MR\\_2020.pdf](https://img03.en25.com/Web/LLNW/%7Bd6493b33-3811-4b20-a410-64c25141adb4%7D_SOOG_MR_2020.pdf) (Assessed: 4 September 2021)
- Lo, S.-K., Wang, C.-C. and Fang, W. (2005). "Physical Interpersonal Relationships and Social Anxiety among Online Game Players", *Cyberpsychology and Behavior: The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society*, Vol. 8, pp. 15–20. <https://doi.org/10.1089/cpb.2005.8.15>
- Lopez-Fernandez, O., Williams, A. J., Griffiths, M. D. and Kuss, D. J. (2019). "Female Gaming, Gaming Addiction, and the Role of Women Within Gaming Culture: A Narrative Literature Review", *Frontiers in Psychiatry*, Vol. 10, 454
- Martončik, M. and Lokša, J. (2016). "Do World of Warcraft (MMORPG) players experience less loneliness and social anxiety in online world (virtual environment) than in real world (offline)?", *Computers in Human Behavior*, Vol. 56, pp.127–134.
- Mihara, S. and Higuchi, S. (2017). "Cross-sectional and longitudinal epidemiological studies of Internet gaming disorder: A systematic review of the literature", *Psychiatry and Clinical Neurosciences*, Vol. 71 No. 7, pp. 425-444.
- Molesworth, M. (2009). "Adults' consumption of videogames as imaginative escape from routine", *Advances in Consumer Research*, Volume 36, pp. 378-383.
- Prensky, M. (2012). *From Digital Natives to Digital Wisdom: Hopeful Essays for 21st Century Learning*, Corwin Press.
- Quantic Foundry LLC. (2016). *Gamer Motivation Model—Overview and Descriptions*. Available at: <http://quanticfoundry.com/wp-content/uploads/2015/12/Gamer-Motivation-Model-Overview.pdf> (Assessed: 7 September 2021)
- Quick, J. M., Atkinson, R. K. and Lin, L. (2012). "Empirical taxonomies of gameplay enjoyment: Personality and video game preference", *International Journal of Game-Based Learning*, Vol. 2 No. 3, pp. 11-31.
- Quwaidar, M., Alabed, A. and Duwairi, R. (2019). "The Impact of Video Games on the Players Behaviors: A Survey", *Procedia Computer Science*, Vol. 151, 575–582. <https://doi.org/10.1016/j.procs.2019.04.077>
- Rusia, N. and Gravoso, R. (2009). "Conditions leading to addiction and avoidance of massively multiplayer online role playing games (MMORPGs) among game addicts", *Annals of Tropical Research*, Vol. 31 No. 2.
- Russoniello, C., O'Brien, K. and Parks, J. (2009). "EEG, HRV and Psychological Correlates while Playing Bejeweled II: A Randomized Controlled Study", *Studies in Health Technology and Informatics*, Vol. 144, pp. 189–192.
- Schmierbach, M. (2010). "'Killing Spree': Exploring the Connection Between Competitive Game Play and Aggressive Cognition", *Communication Research - COMMUN RES*, Vol. 37, pp. 256-274.
- Von der Heiden, J. M., Braun, B., Müller, K. W. and Egloff, B. (2019). "The Association Between Video Gaming and Psychological Functioning", *Frontiers in Psychology*, 1731.
- Warnick, A. (2019). "Video games and health: Sorting science from popular beliefs — Many believe games cause gun violence. *The Nation's Health*" Vol. 49 No. 8, pp. 1-12.
- Whitbourne, S. K., Ellenberg, S. and Akimoto, K. (2013). "Reasons for playing casual video games and perceived benefits among adults 18 to 80 years old", *Cyberpsychology, Behavior, and Social Networking*, Vol. 16 No. 12, pp. 892-897.
- Yee, N. (2006). "Motivations for play in online games", *CyberPsychology and Behavior*, Vol. 9 No. 6, pp. 772-775.
- Yip, F. W. and Kwan, A. C. (2006). "Online vocabulary games as a tool for teaching and learning English vocabulary", *Educational media international*, Vol. 43 No. 3, pp. 233-249.
- Zelinski, E. M. and Reyes, R. (2009). "Cognitive benefits of computer games for older adults", *Gerontechnology: International Journal on the Fundamental Aspects of Technology to Serve the Ageing Society*, Vol. 8 No. 4, pp. 220–235.