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RESEARCH ARTICLE

A Statistical Analysis of the Impact of Gaming on Undergraduates Mental and Physical Health in the Digital Age

Ting Tin Tin[1*], Loh Chee Hong[2], Ng Lok Teng[3], Paul Chin Ti Sheng Alberione[4], Tan Ee Ming[5], Wan Nor Al-Ashekin Wan Husin[6], Ali Aitizaz[7], Lee Kuok Tiung[8*], Sunday A. Afolalu[9], Umar Farooq Khattak[10]

[1,6,9] Faculty of Data Science and Information Technology, INTI International University, Nilai, Malaysia
[2-5]Faculty of Computing and Information Technology, Tunku Abdul Rahman University of Management and Technology, Kuala Lumpur, Malaysia
[7]School of technology, Asia Pacific University, Malaysia
[8]Faculty of Social Science and Humanities, Kota Kinabalu, Universiti Malaysia Sabah, Malaysia
[9]Department of Mechanical and Mechatronics Engineering, Afe Babalola University, Ado-Ekiti, Nigeria
[9]Department of Mechanical Engineering Science, University of Johannesburg, South Africa
[10]School of IT, Unitar International University, Malaysia

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***Corresponding Author:**

tintin.ting@newinti.edu.my

ABSTRACT

It is known that gaming helps relieve stress and emotional problems. However, excessive time spent playing video games may have an impact on physical and mental health. This could have possibly led to mental ill and physical imbalance. Despite the increasing number of research exploring the impact of gaming on undergraduate mental and physical health, there is still a critical gap in understanding the differential effects of various genres of gaming on specific aspects of mental and physical health. This necessitates a concentrated inquiry in order to clarify the complex relationships between various gaming genres and their effects on undergraduate students' wellbeing. In this research, various types of game genres will be experimented with to emphasize the relationship between each game genre with the mental and physical wellbeing. A total of 171 responses have been collected through an online questionnaire survey. PSPP will be used to measure and identify the relationship of the questionnaire items. Cronbach's alpha is used to measure the reliability of the items and bivariate correlation is used to identify the significance level of each relationship on specific mental and physical health. The result of this study revealed that each genre has a different correlation with mental and physical health. This research investigates a variety of genres of gaming, expands theoretical understanding, and discovers connections with specific health outcomes such as addiction to gaming, anxiety, depression, and sleep disorders. This information can help educators and medical experts to encourage healthy gaming behaviors, as well as policy development which makes it easier to create regulations to protect undergraduates' wellbeing in a digital environment.

INTRODUCTION

Gaming is essentially necessary for some people, especially students, to relieve themselves of stress and academic issues. The statistics of the number of gamers around the world have been increasing by 100 million over the year. By taking a closer look at the regional breakdown, the statistics show

that the Asia region has the most number of gamers, approximately 1.48 billion gamers, while Europe comes in second with 715 million gamers in total, and Latin America in third with a total of 420 million of gamers. Not only that, most of the gamers were found to be within the age of 18 to 34 years old, around 1.17 billion of gamers. This has shown that necessary actions are essentially needed to be taken in order to reduce the rate of gamers experiencing mental illness and physical imbalance. The reason behind each gamer is often different as some just want to relax and unwind, while some just want to be entertained.

However, excessive gaming can have negative effects. It is a very common occurrence when people want to play video games for a relatively long period of time. It is comforting to play video games and not to care about stuff such as academics, work, assignments, etc. However, it is a certain fact that gaming can affect mental and physical wellbeing by messing up your daily schedule. Some people prefer to play video games than having to take care of their own health by eating a proper lunch, exercising and doing work. Based on (Merino et al., 2018), it is found that excessive gaming is more likely to affect one's mental state in terms of depression.

The effects of competitive games on people's BMI, depression, and sleep disorders are found to have little to no effect. (Vuorre et al.,2022; Leis et al., 2020; Mateo-Orcajada, 2022). Furthermore, the effects of playing competitive games on their sleep disorder is more closely related to their mental state than the competitive game alone (Altintas, 2019). On the other hand, exergames are found to improve a person's mental state, as well as physical health (Seo et al., 2022). Exergames allow one to actively participate in physical activity instead of slacking, which could greatly improve one's physical health (Zheng et al., 2019). In addition, violent games have a complex relationship with positive and negative effects on players' mental and physical health. Some studies show positive benefits such as improving productivity and reducing negative emotions (Rosa et al., 2022, Pallavicini et al., 2022), while others highlight risks such as poor academic performance, sleep disturbances, and mental distress (Khalil et al., 2019, Hartman et al., 2019, Sabri et al., 2020). Furthermore, most studies show that role-playing games (RPG) have a significant impact on mental health of gamers such as addiction, anxiety, and depression (King et al., 2019; Green et al., 2020; De Pasquale et al., 2020). However, studies show that RPGs have been wrongly associated with mental health issues in the past due to media reports linking them to teenage problems (Baker et al., 2022), and RPG could help teenagers deal with long-term health issues such as anxiety (Babichenko et al., 2023). In conclusion, it is found that the different genres of games can have different effects on one's mental and physical health. Therefore, through experimentation, this study aims to find ways to positively affect one's mental and physical wellbeing.

Additionally, most of the research focuses on the impact of gaming towards a certain range of age in the society. Rarely are studies done on part of the Malaysian population resulting in the impact of gaming towards Malaysians that still remain unclear. Therefore, this study focuses on the effects of mental and physical health in TARUMT undergraduates' and does not focus on other age gaps or other universities.

2.0 LITERATURE REVIEW

2.1 Exergames

Exergames are a combination of both technology and video games where it plays out as a form of exercise to progress the gameplay by tracking the body movements of the user (Oh & Yang, 2010). According to multiple research studies, exergaming has been shown to show a positive effect on cognition that includes depression and Anxiety (Xu et al., 2021; Lucas Murrins Marques et al., 2023; Fernandes et al., 2022). Assume that the correlation between exergaming on mental health (Depression, Anxiety) and physical well-being (BMI) is negative based on the other previous studies (Seo et al., 2022; Singh et al., 2023). The result showed that exergaming has the potential to reduce not only the depressive symptoms and anxiety levels of the users but also improve their physical health in terms of their weight and body mass. According to Ismail et al. (2022), Zheng et al. (2019), the effects of cognitive and physical activities can be improved by performing physical activities

through exergaming. There are university students who have sleep deprivation and emotional problems due to stress, depression, and anxiety, research found out that exergaming can significantly improve their psychological health and sleep (Tan et al., 2020; Hastürk et al., 2022; Jam et al., 2011). Most of the research studies closely related to the effects of exergaming on depression and anxiety have been studied extensively studied, finding that they have better depressive effects on depression and anxiety the longer the intervention (Viana et al., 2020; Heinbach et al., 2021; Huang et al., 2022; Yen & Chiu, 2021). Although multiple studies supported the relationship between exergaming on depression and anxiety that has positive effects, there are also studies that found that exergaming has little to no effects on depression and anxiety reduction (Fernandes et al., 2022; Alajlani et al., 2022). Although research on the effects of gaming on mental and physical health has been reviewed significantly. There is still very little to no research which is towards the effects of exergaming on Malaysian undergraduate sleep disorder and gaming preoccupation (Table 1). Therefore, the purpose of this study is to discover the impacts of exergaming on Malaysian undergraduate sleep disorder and gaming addiction.

2.2 Role-playing Games (RPG)

Role-playing games (RPGs) are a genre of video game in which the player takes on the role of a fictional character. In this study (King et al., 2019; Jam et al., 2013), it was found that compared to players of other types of games, RPG players are more prone to gaming disorders such as gaming addiction. This is because RPG players have significantly lower empathy scores than nonplayers and they find it more difficult to connect with others, and integrate into groups, and therefore are at a higher risk of developing gaming addiction (Kim et al., 2022). Another impact of RPGs on players' mental health is anxiety where it has positive and negative relationships. Some research has found that RPG players experience higher levels of anxiety, as RPG games offer multiple possible outcomes, and players may feel anxious when their choices do not lead to the desired results (De Pasquale et al., 2020). However, other studies have shown that RPG games can help improve mental health by reducing feelings of anxiety (Baker et al., 2022). This is because in RPG games, the "Masks" role-played by players can help teenagers dealing with long-term health issues feel less anxious (Babichenko et al., 2023). In addition to that, sleep disorder has a positive relationship with RPGs. Kharisma et al. (2020), who found that college students who often play a lot of online video games including RPGs are at risk of addiction, which negatively impacts their sleep quality. This is because excessive gaming will disrupt sleep patterns and diminish sleep quality, which can contribute to the development of sleep disorders. Although numerous studies and articles published on the impact of RPG on physical and mental health of undergraduate students that include gambling addiction, sleep disorders, depression, and anxiety, only a few studies conducted to investigate the impact of RPG on the BMI and most of the articles focus on overseas countries rather than Malaysia (Table 1). This study can fill the research gap, especially in exploring the impact of role-playing games on the physical and mental health of Malaysian undergraduate students.

2.3 Violent Games

Violent games usually involve aggressive graphic gameplay that aims for players to fight, participate in conflict, or carry out harmful actions inside the virtual world of the game. Violent video games can be entertaining, used as a social tool, or even improve individual skills, but have drawn concern for potential negative effects on mental and physical health such as social isolation, psychological distress, obesity, and many more (Asko, 2023). Many studies also showed that players who lack discipline, poor time management, and play violent video games excessively will cause them to have poor grades and reputation in their academic lifestyle (Khalil et al., 2019, Lérida-Ayala et al.,2022, Charmaraman et al.,2020). Furthermore, according to Rosa et al., 2022, violent video gamers can improve their productivity during the day and not always negatively impact their quality of sleep. This shows that the relationship between playing violent video games and sleep disorder can be positively affected by their healthy routine or negatively affected by the intensity of violent video games instead of the amount of time playing them (Salih et al., 2020). Another study by Hartman et al. 2019 demonstrates that players who prioritize playing violent video games instead of sleeping

may affect their memory performance and cause them to develop sleep disorders, which is due to players spending the majority of their time on electronic devices playing violent video games that emit artificial light and negatively impact the players' physical health. Furthermore, recent studies have revealed a complex relationship between playing violent video games and depression. Some studies demonstrate that playing violent video games have positive effects on players, such as reducing their depression, anxiety, stress, and loneliness especially during challenging times such as Covid-19 (Pallavicini et al., 2022, Kowal et al., 2021). On the other hand, a study conducted in Finland shows that playing violent video games excessively also can cause players to experience negative effects like anxiety, depression, lack of confidence, and others (Sabri et al., 2020). Although numerous studies have been conducted to discover the effect of violent video games on player mental and physical health, little study has been done on how these games have an impact towards Malaysian undergraduates. In contrast, several research studies have explored the effects of different genres such as exergames and competitive games that affect Malaysian Undergraduates' physical and mental health (Table 1). Hence, the purpose of this study is to reduce the research gap and to discover whether violent video games have an impact on the physical and mental health of Malaysian undergraduates.

2.4 Competitive Games

Competitive games are those in which players play against one another and where one player winning means another player loses. Most of these games have become a global sport in which teams from all over the world compete for prizes. Esports is expected to show an annual growth of 7.10% by 2028 (Statista, 2023). The relationship between competitive games on their physical (BMI) and mental health (Depression, Sleep Disorder) has been studied extensively and the results have shown that there are little to no effects of playing competitive games (Vuorre el al.,2022; Leis et al., 2020; Mateo-Orcajada, 2022). However, there are also studies that show that there are positive effects on their mental health and state that competitive gaming is a leisure and professional activity (Kelly et al., 2021; Yin et al, 2020). In contrast, according to Matthew Smith et al. (2022), Klier et al. (2022), Lee et al. (2020), and Lee et al. (2021), there are some competitive gamers who have shown signs of lack of sleep, burnout, social phobia, anxiety, and ill mental health. In addition to that, the effects of playing competitive games on their sleeping disorder are more closely related to their mental state than the competitive game alone (Altintas, 2019). Although the reviewed studies have provided valuable insight into the positive relationship between the players' and their physical and mental health, there are some studies reviewed that provide a different result. A specific study done on Norwegian esport students has discovered that they developed lifestyle habits such as skipping morning meals, bluelight explosion at night, and an increase in energy drink consumption (Baumann et al., 2022). It also discovered that competitive gaming is also used as a coping mechanism for people with mental health issues, since certain aspects of motivation, such as exerting control and the achievement/challenge aspect of competitive gaming, are unique to this population (Shi et al., 2019). Furthermore, according to DiFrancisco-Donoghue et al. (2022) and Giakoni-Ramrez et al. (2021), the BMI of competitive gamers is not directly caused by playing the game but more on the players' own choice to maintain a healthy lifestyle or not, which leads to an increase of unhealthy people in the competitive gaming environment, as many of them play competitive games as a coping mechanism. Finally, competitive esport players have been identified to be more depressed than others due to the current employment and earnings as a competitive player (Kocada, 2020). Despite the fact that significant research has been done on the effects of competitive gaming on player mental and physical health, there is a lack of a comprehensive study that explores the different effects of physical and mental health such as Depression, Sleep Disorder and BMI in Malaysian Undergraduates. However, there is multiple research on the said physical and mental health effects on ExerGames, but no research has been done on violent games, competitive games, and Role-Playing Games towards Malaysian undergraduates (Table 1). Therefore, this research aims to determine whether there is an effect of competitive gambling on the physical and mental health.

Table 1: Research Gap References

Genre	Research
Exergame	Wan Yunus et al. (2020) Pallavicini et al. (2022) Liu et al. (2022) Santos (2020) Yusoff et al. (2021)
Role Play	Tang et al. (2022) Li et al. (2021) Heng et al. (2021) Kumar et al. (2021)
Violent	Pallavicini et al. (2022) Liu et al. (2022)
Competitive	Seng et al. (2021) Rasdi et al. (2021)

2.5 Conceptual Framework

Based on the literature reviews conducted in previous sections, this study has constructed a conceptual framework to justify the correlation of game genre with gaming addiction, sleep disorder, depression, anxiety, and body mass (BMI), as shown in Figure 2.

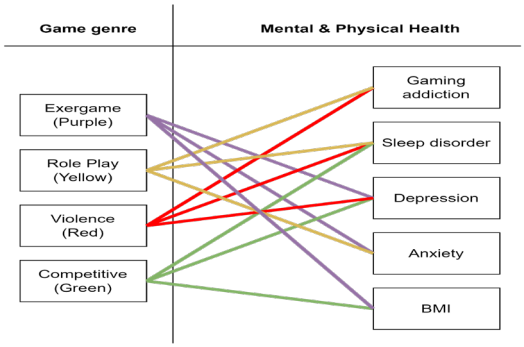

Figure 2*: Conceptual framework*

The hypotheses for this study have been formed based on the conceptual framework in Figure 2 and are shown as follows.

H1: Exergame is significantly negatively related to depression.

H2: Exergame is significantly negatively related to anxiety

H3: Exergame is significantly negatively related to BMI

H4: The role-playing game is significantly positively related to gambling addiction.

H5: Role-playing game is significantly positively related to sleep disorder.

H6: The role-playing game is significantly positively related to anxiety.

H7: Violent games are significantly positively related to Gaming Addiction

H8: Violent game is significantly positively related to sleep disorder

H9: Violent game is significantly negatively related to depression

H10: The competitive game is significantly positively related to sleep disorder.

H11: Competitive games are significantly positively related to depression.

H12: The competitive game is significantly positively related to BMI

3.0 RESEARCH METHODOLOGY

A cross-sectional study is carried out on Tunku Abdul Rahman University of Management and Technology (TAR UMT) undergraduate students for 5 weeks. The population is selected based on simple random sampling on any faculty that offers undergraduate programs which eases data collection. The main reason for the selected population is that any students selected from these faculties will always be an undergraduate student. The Google Survey is distributed by visiting each faculty building and looking for students who are waiting or who have finished their class with the consent of their willingness to participate in the survey before starting and through the use of social media such as whatsapp for faster distribution to a larger sample of undergraduates. We received a total of 171 respondents in the survey.

There are six sections included in the survey (Table 2): section 1 - demographic information; section 2 - body mass index (BMI); section 3 - Mental Health (Anxiety)(Hamilton, 1959); section 4 - mental health (depression) (Hamilton, 1960); section 5 - mental health (gaming addiction scale) (Zul Kamal & Wok, 2020); and section 6 - physical health (sleeping disorder) (Shahid et al, 2012). The hypothesis will be analyzed using Pearson's correlation to test the impact of gaming on mental and physical health. The software used to analyze is PSPP.

Table 2: Questionnaire Items

Questionnaire Items	**Resource**
Section 1 - Demographic & Game Playtime How old are you? What is your gender identity? What is your race? How much time do you spend playing ExerGames in a day? How much time do you spend playing role-play games in a day? How much time do you spend playing violent games in a day? How much time do you spend playing competitive games in a day?	
Section 2 - Physical health (BMI) What is your height? (cm) What is your weight? (kg)	
Section 3 - Mental Health (Anxiety) I frequently have worries, anticipation of the worst, and fearful anticipations. I have feelings of tension, fatigability, and have easily moved to tears. I am scared of the dark, strangers, and being left alone. I have difficulty in concentration and poor memory. I feel pain and aches, twitching, and stiffness. I am having blurring of vision, and hot and cold flushes. I have feelings of pain in chest, and fainting feelings.	Hamilton, 1959
Section 4 - Mental Health (Depression) I have experienced denunciatory voices and visual hallucinations due to my guilt. I have feelings of worthlessness in life and thoughts of suiciding I find it hard to concentrate on something I have the habit of biting nails, hair-pulling, and biting lips I have difficulty falling asleep and frequently waking up at night I have no interest in any activity and lack of pleasure in hobbies I frequent deny of being ill while being in sick condition	Hamilton, 1960
Section 5 - Mental health (Gaming Addiction Scale) I always find a way to play video games.	Zul Kamal & Wok, 2020

I always skip my meals because I want to play video games. I spend my whole night playing video games. I spend a longer time playing video games rather than communicating with my family. I will make sure the Internet connection is always good so I can play video games. I spend a longer time playing video games rather than hanging out with my friends. I spend a longer time playing video games rather than studying or doing assignments.	
Section 6 - Physical health (sleeping disorder) Daily average sleep duration I would like to sleep more after waking up. I have difficulty getting out of bed. I have difficulty getting back to sleep once I wake up in the middle of the night. I have a hard time to focus on important tasks	Shahid et al, 2012

4.0 RESULTS AND DISCUSSIONS

A total of 171 undergraduates participated in this study with their demographics, as shown in Table 3. There is a total of 61.4% of male undergraduates and 38.6% of female undergraduates with a majority of age 18-24 years old (72.7%). 76.0% of the undergraduates are Chinese followed by Indian with 9.9%.

Table 3: Demographic

Characteristics	Frequency(n)	Percentage(%)
Age		
18-24	124	72.7
25-34	44	25.6
34+	3	1.7
Gender		
Female	66	38.6
Male	105	61.4
Race		
Chinese	138	80.7
Indian	17	9.9
Malay	16	9.4
Total	171	100.0

Based on Table 4 The reliability level for the game genres is unacceptable (<0.5). The reliability level for physical and mental healths (gambling addiction, sleep disorder, depression, anxiety, BMI) are poor (0.5 - 0.59), acceptable (0.7 - 0.79), good (0.8 - 0.89), and excellent (>= 0.9). The reliability of all variables is questionable (0.6 - 0.69).

Table 4: Reliability Level Summary

Variable	Cronbach Alpha	Items
Game Genres	0.25	4
Gaming Addiction	0.87	7
Sleeping Disorder	0.73	5
Depression	0.92	7
Anxiety	0.84	7
BMI	0.59	2
Overall	0.60	32

4.1 Exergames Analysis

The significance level of H1 is shown to be significant and, therefore, is accepted based on Table 5 where exergaming is found to have a significant effect on depression. The findings of this study are consistent with most of the studies reviewed on the effects of exercise on depression (Heinbach et al., 2021; Huang et al., 2022; Yen & Chiu, 2021). Studies have shown that performing physical activity intensively through exergaming can significantly improve one's cognition and emotion, while physically exercising can serve as a stress reliever or a mediation. However, exergaming seems to have no effect on both anxiety and BMI (H2 and H3 are rejected). There are studies that indicate that there is a significant relationship between exergaming and anxiety (Singh et al., 2023; Borges Viana et al., 2020). The results of the studies are different from this study; it may be due to the fact that the study is based on simple random sampling where the risk of bias could vary from low to high at a random rate. According to (Borges Viana et al., 2020), exergaming proves effects on anxiety levels can vary across different populations. The results of H3 are also inconsistent with other studies that have shown that exergaming has a significant effect on BMI (Seo et al., 2022; Yu et al., 2020). The difference in the result could be due to the activeness of the sample, the sampling technique is collected in simple random sampling which would have indicated that the intensity of exergaming was not controlled.

Table 5: Effects of exergaming on mental and physical health

Hypothesis	Dependent variable	Independent variable	Pearson correlation (r)	Sig. (2-tailed) (p)
H1	Depression	EP	-0.338**	0.000
H2	Anxiety	EP	0.008	0.913
H3	BMI	EP	0.061	0.428

Note: EP = Exergames playtime per day. **Correlation is significant at 0.01 level (2-tailed) & *Correlation is significant at 0.05 level (2-tailed).

An additional analysis is conducted as shown in Table 6. The additional analysis found that the relationship between exergaming and sleep disorder is significantly negative. This result is consistent with a study in which it is tested that exergaming will be able to help university students relieve their sleep deprivation and emotional problems (Tan et al., 2020). However, the correlation between exergaming and addiction is negative but not significant. This study is consistent with a study conducted on undergraduate and postgraduate students where gaming addiction is negatively associated with exergaming, that is, physical activity (Chen et al., 2022; Adekunle., 2024).

Table 6: Additional analysis of effects of exergaming on mental and physical health

Dependent variable	Independent variable	Pearson correlation (r)	Sig. (2-tailed) (p)
Sleeping disorder	EP	-0.225**	0.001
Gaming addiction	EP	-0.12	0.119

Note: EP = Exergames playtime per day. **Correlation is significant at 0.01 level (2-tailed) & *Correlation is significant at 0.05 level (2-tailed).

4.2 Analysis

Table 7 indicates that the hypothesis H4 (positive relationship between role playing and Gaming Addiction) hypothesis was accepted ($p < 0.05$). This suggests that H4 is consistent with other studies (Dieris-Hirche et al., 2020; Kim et al., 2022; Lee et al., 2020), showing that rich content, customization items, and gameplay in role-playing games make players more likely to immerse themselves, requiring them to spend a lot of time trying to achieve the achievement, making players more prone to addiction. Regarding H5 (positive relationship between role playing game and Sleep Disorder) is

rejected ($p > 0.05$) and the result of this hypothesis is inconsistent with Kharisma et al., 2020. According to the article by J. Lee et al., 2024, despite the players going to bed later than usual, only a few of them slept less than what is recommended (8 hours), and were affected by night awakenings. Regarding H6 (positive relationship between role playing game and Anxiety), the hypothesis was accepted ($p < 0.05$). The hypothesis result is compatible with other articles (King et al., 2019; De Pasquale et al., 2020) showing that RPG games usually have intricate storylines, making players deeply involved in the game world and the fate of their characters. Additionally, players often have to make decisions and take on responsibilities within the game, which can lead to feelings of anxiety due to various factors like uncertainty about the consequences of their choices, the pressure to perform well in challenging situations, and the emotional investment in the virtual world. As a result, these factors will cause players who are engaging in RPG gameplay to experience anxiety.

Table 7: Effects of Role-play games on mental and physical health

Hypothesis	Dependent variable	Independent variable	Pearson correlation (r)	Sig. (2-tailed) (p)
H4	Gaming Addiction	RP	0.402**	0.000
H5	Sleep Disorder	RP	-0.053	0.495
H6	Anxiety	RP	0.277**	0.000

Note: RP = play game per day. **The correlation is significant at 0.01 level (2-tailed) & *correlation is significant at 0.05 level (2-tailed).

There is an additional analysis listed in Table 8 that shows the relationship between Role Playing Game and Gaming Addiction is statistically significant but a negative relationship. The result is a match with Babichenko et al., 2023. Another one is the relationship between Role-Playing Game and BMI, results show that it aligns with this article (Chua et al., 2023).

Table 8: Additional analysis of effects of role-play games on mental and physical health

Dependent variable	Independent variable	Pearson correlation (r)	Sig. (2-tailed) (p)
Depression	RP	-0.168*	0.028
BMI	RP	0.102	0.185

Note: RP = play game per day. **The correlation is significant at 0.01 level (2-tailed) & *correlation is significant at 0.05 level (2-tailed).

4.3 Analysis

Table 9 shows a significant relationship between violent games and Gaming Addiction (H7) which supports the acceptance of this hypothesis ($p< 0.05$). This shows that the study for H7 is consistent with other studies where violent video games can improve players' skill while increasing the risk of developing game addiction (Asko, 2023; Khalil et al., 2019, Lérida-Ayala et al.,2022, Charmaraman et al.,2020). On the other hand, the lack of significance in the relationship between violent games and Sleep Disorder (H8) shown in Table 9 caused it to be rejected. The study for H8 may appear to contradict other studies such as Hartman et al., 2019 which is due to the various gaming habits and lifestyle of the participants that could change the observed outcomes. For example, some players may experience sleep disruption due to excessive gaming and long exposure to artificial light (Hartman et al., 2019), while others may maintain healthy sleep routines and productivity levels without experiencing negative effects of gaming (Rosa et al., 2022). According to Table 9, the relationship between violent games and Depression (H9) is significant and accepted. This result is consistent with other studies that reveal that playing violent video games could be beneficial in reducing players' feelings of anxiety and depression during challenging times (Pallavicini et al., 2022; Kowal et al., 2021).

Table 9: Effects of Violent Games on Mental and Physical Health

Hypothesis	Dependent variable	Independent variable	Pearson correlation (r)	Sig. (2-tailed) (p)
H7	Game Addiction	VP	0.402**	0.000
H8	Sleep Disorder	VP	-0.053	0.495
H9	Depression	VP	-0.168*	0.028

Note: VP = playing time of violent games per day. **The correlation is significant at 0.01 level (2-tailed) & *correlation is significant at 0.05 level (2-tailed).

In addition, Table 10 represents an additional analysis that examines the effects of violent games on Anxiety and Body Mass Index (BMI). The result shows a significant weak positive relationship between violent games and Anxiety which aligns with other studies like Pasquale et al., 2021 and Coyne & Stockdale, 2021. Studies suggest that playing violent games for a long time can increase the risk of experiencing anxiety. Also, the result also demonstrates a weak positive relationship between violent games and Body Mass Index (BMI) but it is not statistically significant. This indicates that playing violent games can influence the changes in BMI (Ponce-Blandón et al.,2020). Another study by Krarup & Krarup, 2020 indicates that long gaming sessions could increase the BMI of violent video gamers, while moderate gaming allows the gamers to maintain their BMI levels more effectively.

Table 10: Additional Analysis of effects of Violent Games on Mental and Physical Health

Dependent variable	Independent variable	Pearson correlation (r)	Sig. (2-tailed) (p)
Anxiety	VP	0.277**	0.000
BMI	VP	0.102	0.185

Note: VP = playing time of violent games per day. **The correlation is significant at 0.01 level (2-tailed) & *correlation is significant at 0.05 level (2-tailed).

4.4 Analysis

Based on Table 11, H10 and H11 are accepted because $p < 0.05$. H10 is consistent with Lee et al. (2021), Seiler and Wagner (2022) and Lee et al. (2020). Research has shown who most people that play competitive games have delayed sleep schedules, which causes lower sleep duration but does not affect sleep quality, and prolonged exposure to blue light (especially just before bedtime) that can disrupt sleep patterns (Lee et al. 2021). H11 is in line with the findings of Lee et al. (2020) and Pua et al. (2021). According to Humries et al. (2020), most people who play competitive video games on an average of more than 2 hours a day show depressive symptoms. H12 is rejected because $p > 0.05$ which is consistent with Giakoni-Ramírez et al. (2021). The results show that people who play competitive games do not have a higher body mass index (BMI) value compared to people who do not play competitive games, which is in contrary of the findings of DiFrancisco-Donoghue et al. (2020), where they discover that there are significant differences between college competitive game players and other sports, finding higher levels of fat and in the competitive game players. They have also said that BMI is not an accurate measure of a competitive game player.

Table 11: Effects of Competitive Gaming on mental and physical health

Hypothesis	Dependent variable	Independent variable	Pearson correlation (r)	Sig. (2-tailed) (p)
H10	Sleeping DIsorder	CP	0.448**	0.000
H11	Depression	CP	0.660**	0.000
H12	BMI	CP	-0.260	0.367

Note. CP = playing time of competitive games per day. **The correlation is significant at 0.01 level (2-tailed) & *correlation is significant at 0.05 level (2-tailed).

Additional analysis has been performed and the results are shown in Table 12. Both anxiety and gaming addiction show a weak relationship with competitive games. The result of anxiety is in contrast to Pichon et al. (2020), where anxiety was more associated with aggressive behavior than playing competitive games. The analysis of gaming addiction is consistent with Kim et al. (2022) , where competitive gamers have higher levels of risk of gaming addiction compared to other genres of games.

Table 12: Additional analysis of effects of competitive gaming on mental and physical health

Dependent variable	Independent variable	Pearson correlation (r)	Sig. (2-tailed) (p)
Anxiety	CP	0.274**	0.000
Gaming Addiction	CP	0.220**	0.004

Note. CP = playing time of competitive games per day. **The correlation is significant at 0.01 level (2-tailed) & *correlation is significant at 0.05 level (2-tailed).

5.0 CONCLUSIONS

This research has proven the relationships between different genres of games with respect to the physical and mental health. It is determined that exergames can greatly reduce the user's depression and sleeping disorders, however, it has been found that exergames have no effect on anxiety, gaming addiction and BMI. It is shown that competitive games will lead to sleep disorders, depression. anxiety and gaming addiction towards the player but has no effect on their BMI. The research has demonstrated that violent games will cause players to develop gaming addiction, depression, and anxiety, while it does not cause sleep disorders and has no effect on their BMI. Lastly, this research has shown that role-playing games will let players have more gaming addiction and anxiety. It has no effect on sleep disorder and BMI. Surprisingly, RPGs can reduce the depression of a player.

The limitation of this study is that we focus on undergraduate students from TAR UMT only with a sample size of 171 students. This research only has a small sample size as well as focuses on only one university and has a limited age gap of students. This research only tests 1 physical health (BMI) and 4 mental health (sleeping disorder, depression, gambling addiction, anxiety). This research does not include people such as children, adults and elderly people. Moreover, this study uses simple random sampling to collect data and thus may lead to defect or unstable results. Future work is suggested to assess the effects on a larger sample and population size, as well as a wider age gap, and include multiple universities. It is also recommended to use a more controllable methodology to gather data to maintain the stability and accuracy of the study results. In addition to that, more research should be done on different types of physical and mental health, as there are multiple categories of physical and mental health.

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7.0 APPENDIX

Table A1. Questionnaire Details

Section	Questionnaire Items	Options
Demographic & Game playtime	Age	18-24; 25-34; 34+
	Gender	Male/Female
	Race	Malay; Chinese; India; Other
	Time spent playing exergames/role play games/violent games/competitive games	None; Less than 1; 1 to 2; 2 to 3; More than 3
Physical Health (BMI)	Height	
	Weight	
Mental Health (Anxiety)		
I frequently have worries, anticipation of the worst, and fearful anticipations.		Never
I have feelings of tension, fatigability, and moved to tears easily.		0
I am scared of the dark, strangers, and being left alone.		1
I have difficulty in concentration and poor memory.		2
I feel pains and aches, twitching, and stiffness.		3
I am having blurring of vision, and hot and cold flushes.		4
I have feelings of pain in chest, and fainting feelings.		Often
Mental Health (Depression)		
I have experience denunciatory voices and visual hallucinations due to my guilt		Never
I have feelings of worthlessness in life and thoughts of suiciding		0
I find it hard to concentrate on something		1
I have habits of biting nails, hair-pulling, and biting lips		2
I have difficulty falling asleep and frequently waking up at night		3
I have no interest in any activity and lack of pleasure in hobbies		4
I frequent deny of being ill while being in sick condition		Frequent
Mental Health (Gaming Addiction Scale)		
I always find a way to play video games.		Never
I always skip my meals because I want to play video games.		0
I spend my whole night playing video games.		1
I spend a longer time playing video games rather than communicating with my family.		2 3
I will make sure the Internet connection is always good so that I can play video games.		4 Often
I spend a longer time playing video games rather than hanging out with my friends.		
I spend a longer time playing video games rather than studying or doing assignments.		
Physical Health (Sleeping Disorder)		
Daily average sleep duration		<5 hours; 6-7 hours; >8 hours
I would like to sleep more after waking up.		Rarely
I have difficulty getting out of bed.		0
I have difficulty getting back to sleep once I wake up in the middle of the night.		1
I have a hard time to focus on important tasks		2 3 4 Often