



RESEARCH ARTICLE

Exploring Video Games Impact on Mental Health among University Students

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ARTICLE INFO	ABSTRACT
Received: Sep 13, 2024	<p>With the rapid advancement of technology in Malaysia, the number of video games is increasing. According to a survey by Statista 2023, 31% of respondents who are video game users were born in the mid-to-late 1990s and 47% of all respondents were holding bachelor degrees or equivalents. Two key genres of video games including RPG and violent games are studied. The research aims to study the impact of those two genres of video games on university students in Malaysia. The most visible question to be answered is the hours of participation of university students in those two genres of games. Although many connections between video games and mental health have been proven in many studies, there is also a lack of research on whether mental health acts as a mediator for relationships between video games and academic performance, as well as physical health. Furthermore, tons of research suggests that video games impact mental health, and it is also known that mental health can influence academic performance and physical health. However, there are few studies that investigate whether mental health acts as a mediator in the relationship between video games and these outcomes. 302 participants were involved in the study and the data were analyzed through Pearson's correlation, Chi square, and process macro. Our research shows that RPG and violent games present a significant impact on mental health. Furthermore, video games, specifically violent games and anxiety, cause the individual to have low physical health. However, the mediating effects between video games and academic performance, video game, and physical are not significant in our study. This research provides a supportive perception toward the engagement of RPG and violent games that may impact mental health or physical health. This is useful as guidance to policy makers, video game creators, educators, and healthcare professionals in Malaysia.</p>
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INTRODUCTION

According to Ayenigbara, video games refer to software applications that are playable on various computing devices such as computers, gaming consoles, and mobile phones (Tang et al., 2022). One of the simplistic definitions of video games would be 'a computer game designed mainly for entertainment purposes' (Salleh, A., & Abdul Ghani, R., 2022). Ralph Bear, the creator of the first

prototype video game console named 'Brown Box', has been the first to engage in this kind of entertainment (Fong et al., 2019). This marks the beginning of all forms and genres of video games being widely produced and spread globally, especially in Malaysia. Based on a survey by Statista 2023, the population in video games where 31% of all respondents are born in mid-to-late 1990s and 47% of all respondents tend to hold bachelor degrees or equivalents (Statista, 2023). In addition, Malaysia was ranked 21st out of the top 100 countries in contributing \$633 million in revenue for digital games (Newzoo's 2018 Global Games Market Report). With a rapid increase in popularity of video game players, concerns whether it will benefit or harm us in terms of physical or mental health will slowly increase.

One of the key genres of video games are Role-Playing Games (RPGs), it is arguably among the most diverse forms of games available (Stanisic, 2019). One of the most famous Role-Playing Games (RPG), Genshin Impact, accumulated 4.07 million downloads worldwide accompanied by monthly in-app purchases that are estimated to be at around 51 million US dollars (J. Clement, 2024). Furthermore, violent video game sales have increased by more than 204% from 2005 to 2020 (Jannik Lindner, 2023). Video games are able to improve cognitive skills and help regulate the mood of an individual (Charles Reynaldo, 2021). However, excessive gaming has also been associated with negative consequences, including sleeping disorder, decreased life satisfaction, difficulty focusing, depression, and aggressive behavior (Emin Altintas et al., 2019; Bargeron & Hormes, 2017; Hyera Ryu et al., 2018).

Therefore, the study conducted aims to provide us an understanding of the relationship between two famous genres of video games, which are role-playing games (RPG) as well as Violent games and the mental health of university students. The study focuses on three aspects for the effects of the games mentioned in terms of academic performance, physical health, and mental health which includes anxiety, sleeping disorder, and depression. This knowledge can inform the development of evidence-based strategies to promote positive mental health and responsible gaming habits within the university students.

1.1 Research Problem Statement

In Malaysia, video games have become a dominant form of entertainment, particularly among students. While offering opportunities for leisure, social interaction, and possibly even cognitive development, concerns about their potential impact on mental health are on the rise. Existing research on video games and mental health presents conflicting findings. Some studies suggest a link between excessive video game use and increased anxiety, depression, and even violent behavior. However, other studies find minimal or even positive effects. This inconsistency creates a knowledge gap on the true impact of video games on mental health, especially among Malaysian students. Understanding the relationship between video games and mental health is crucial to promoting well-being among students in Malaysia. If a negative association exists, targeted interventions and policies can be developed to promote responsible gaming habits and mitigate potential harm. Additionally, understanding the positive aspects of video games could inform strategies to leverage their potential benefits.

This study aims to investigate the impact of video games on mental health among students in Malaysia. Research will explore the time students spend on different types of games weekly; the relationship between video game use and mental health symptoms, such as anxiety, depression, and sleep disorders; and the mediating effect of mental health in a relationship between video games and academic performance, as well as physical health.

1.5 Research Contribution

The research contributes to understanding the correlations between two genres of video games which are role-playing games (RPG) and Violent games with mental health including depression, anxiety, and sleeping disorder. In addition, it contributes to understanding of the connections between mental health and two factors, academic performance as well as physical health. It is

important to explore the following connections to study the behavior of the university students in Malaysia.

2.0 REVIEW

2.1 Video games in Malaysia

The Malaysian National Creative Industry Policies, overseen by the Ministry of Communications and Media, have identified the gaming sector as one of the key segments within the Creative Industry (Tan Mei Si, 2020). This sector is part of a broader spectrum that includes visual arts, performing arts, music, literature, fashion and Design, Traditional and cultural arts, creative education, creative technologies, film, television, gaming content, and culinary arts (MIDA, 2020). In 2018, the Gaming Industry alone made a significant contribution of USD 100 million to Malaysia's revenue and is expected to witness a yearly growth rate (CAGR 2018-2023) of 10.9 percent. This growth trajectory is expected to result in a market volume of USD 168 million by 2023 (The Malaysia Reserve, 2024). The standing of Malaysia in the global gaming market is also noteworthy, ranking 21st worldwide in terms of games revenue, with a total amount of USD 633 million (MIDA, 2020). Apart from that, the projected revenue in the Video Games market in Malaysia is expected to reach US\$649.30m in 2024. Forecasts suggest that the market is poised for a consistent annual expansion, with a projected compound annual growth rate (CAGR 2024-2027) of 7.55%. This trajectory is expected to culminate in a market volume that reaches US\$ 807.80 million by the year 2027. Moreover, predictions indicate that the user base within the Video Games market is set to expand, potentially reaching 7.0 million users by the same year (Statista Market Forecast, n.d.).

The Malaysia Consumer Price Index (CPI) serves as a critical indicator of the nation's economic landscape, providing insight into the fluctuating trends within specific consumer sectors (Fernando, 2024). In examining the subset of RC: Video Game Computers, Game Consoles, Game Apps & Software, the data unveil a nuanced narrative of market dynamics. As of January 20, 2024, the index was 101.300 2010=100, signaling a marginal increase from its December 2023 counterpart of 101.000 2010=100. This upward trajectory reflects a trend observed over the past year, with an average index of 101.000 2010=100 recorded between January 2023 and January 2024. In particular, January 2024 marks an all-time high for the index, while December 2023 represents its record low within the same timeframe (Malaysia CPI: RC: Video Game Computers, Game Consoles, Game Apps & Software, 2024).

2.2 Impact of video games on Academic Performance

The topic of whether video games affect academic performance of adolescents has been popular for a long time. While some research shows that playing video games is associated with lower academic performance, some research shows the opposite. There is evidence that frequent gaming, especially on weekdays, could cut down homework time and slightly lower grades (Hartanto et al. 2018). Additionally, there was a small to moderate decrease in grades for some weekday gamers, although it only applies to those who played in the mornings before school (Aaron Drummond et al., 2020). However, some studies stated a negative correlation between video games and academic performance (Kwok et al, 2021; Mireia Adelantado-Renau et al., 2019). Although this is true, there is no clear connection between how often adolescents play video games and academic performance. Limitations in existing theories make it hard to fully grasp the association between video games and academic performance (Aaron Drummond, 2020; Lun et al., 2022; Ting et al., 2022).

However, a study found that video games help to improve cognitive skills and decision-making. Cognitive skills such as perception, attentional control, and decision making. High school and undergraduate students who played video games exhibit better results when given tasks related to cognitive abilities compared to students who do not play video games (Charles Reynaldo et al., 2021). In addition, students who excel in academics tend to allocate a lot of time playing video games, in fact, almost the same as their study time. Video games basically played a crucial role as a self-reward mechanism in their academics (Slobodan Adzic, 2021). Many popular video games encompass high levels of violent content, where actions such as killing or harming other characters are central to the

gameplay experience (Lukas Leopold Lengersdorff, 2023). Interestingly, Malaysian adolescents preferred violent games where the games themselves depict aggressive behavior and lack of sense of empathy (Roy Rillera Marzo et al., 2019), these behaviors would affect academic performance (Joanne Savagelow et al., 2017).

Compared to role-playing games, it acts as a medium for academic performance through numerous studies. These games offer an engaging narrative that facilitates opportunities for student development. In addition, educators in North America and Asia implemented the games that resulted in an increase in self-efficacy, engagement and motivation among students, which are reported by the teachers (Heinz & Prager, 2019). In an experiment, students who were instructed through role-playing simulation activities attained better final grades and pass rates compared to those who were taught using traditional methods (Barrera, 2020). The rationale is that RPG-based assessment provides a high level of engagement and dynamic content. The dynamic learning environment consisted of sound, animation, and interactive elements where it encouraged students to participate in learning, thereby reducing their anxiety about learning and increasing their motivation to learn. Consequently, this contributed to improvements in academic performance (Chiu, FY & Hsieh, M. L. 2017). In addition to that, role-playing games help to improve collaboration and communication skills, as well as their educational potential when accompanied by small structured debriefing sessions (Prager, R., 2019).

2.3 Impact of video games on physical health

Based on some recent research, video games may impact physical health in different aspects, such as higher BMI, higher body fat, less lean body mass (mass without fat), less active and poor sleeping quality. Video games may have an association with increased gaming time and higher BMI, lower-self reported physical health (Pelletier et al., 2020). Collegiate esports players who engage in video games constantly have significantly higher body fat percentage, less lean body mass (mass without fat) and are less active than non-esport players (Joanne DiFrancisco-Donoghue, 2022). Apart from that, hours of engaging in video games will lead to deterioration in physical health and behaviors, including BMI and general health status (Pelletier et al., 2020). Furthermore, with these long hours of high intensity video games at a high intensity, sleep quality will be heavily affected (Emin Altintas, 2019), while poor sleep quality can lead to higher bmi (Giovanna Muscogiuri et al., 2020). In an experiment conducted in Hong Kong, it was indicated that spending tons of time playing on the Internet is associated with lower levels of physical activity (Kwok et al., 2021). In fact, a study shows that excessive involvement in video games will have low physical fitness, poor dietary habits, and high sedentary time (Puolitaival et al., 2020). With such low levels of physical activity and the widespread habit of sedentary lifestyle, body mass index (BMI) and junk food consumption will slowly increase (Cabanas Sanchez et al., 2020). The result of these prolonged screen time and hours of sedentary behavior will bring about numerous chronic diseases (Rudolf et al., 2020). Video games may not be a factor in physical health, as one of the studies suggested that college students with food insecurity tend to have poor physical health (Hagedorn et al., 2021). The life satisfaction of an individual may also be related to physical activity, meaning that the higher their life satisfaction, the greater the probability of physical activity (Urchaga et al., 2020).

In order to prevent such an amount of physical activity to continuously decline, is to implement Active Video Games (AVGs). Video games that require the player to physically move are defined as Active Video Games (AVG) also known as “exergames” (Kann et al., 2018). Engagement in Active Video Games (AVG), including electronic motion games, will undoubtedly contribute to daily caloric consumption and functions as a tool for people with low rate of physical activity (Santos et al., 2021). On the other hand, there is also immersive VR exergaming, where it attracts a large number of players compared to traditional exercise as it diverts their attention towards the fatigue associated with physical activity. The advancement of VR exergames to the next stage was proposed by experimenting with virtual running which allows Role-Playing Games (RPG) exergames to be designed (Khundam & Nol, 2021). Malaysian Sports Culture Index (MSCI) 2022 indicates that half of the population in Malaysia is still not engaged in sports activities or involved in physical activities occasionally (Aman et al., 2024). As for this, fitness role-playing games (RPGs), including Shikudo

Inc., will play a crucial role in helping to increase the amount of motivation to participate in physical activities (Zulkifli & Danis, 2022).

2.4 Impact on Mental health

According to the Mental Health Foundation (Stahmer et al., 2012), one's thoughts and feelings about oneself and life have a significant impact on their ability to cope and manage through difficult circumstances. Mental health is believed to have an impact on the capacity of an individual's ability to operate, take advantage of opportunities, and fully engage fully with peers, family and the workplace. Physical and mental health are closely related since they influence each other both directly and indirectly (Dinesh Bhugra et al., 2013). Mental illnesses are universal and prevalent in all nations (World Health Organization [WHO], 2023). Edith Humries et al. (2020) suggests a potential correlation between depression and the presence of violent content in video games. It mentions that individuals, both adults and children, who are frequently exposed to real-life violence, either as observers or recipients, will lead to adverse mental health consequences such as depression, anxiety, and strong aggressive behavior (Mingchen Wei et al., 2022). Furthermore, engaging in prolonged sessions of computer or video games can lead to a range of physical, mental, social, and physiological problems (Lucio Gros et al., 2020). These may include increased aggression, poor school performance (Veronica Rosendo-Rios et al., 2022), obesity, depression, sleep disorders, and anxiety (Virginia Lérída-Ayala et al., 2022).

In fact, the WHO recently classified gaming disorder as a mental health condition and included it in the international medical list. It is not simply about excessive online gaming, but rather the impact it has on our daily lives and the main cause of mental illness to arise (Rettner, 2019). Gaming disorder manifests itself as a persistent and uncontrollable gaming pattern, where people prioritize gaming over other responsibilities and suffer negative consequences. These consequences can affect social life, education, and family relationships (Rettner, 2019). Internet Gaming Disorder (IGD) is identified as addictive behavior (Fachrul A. Nasution et al., 2019), associated with psychological and health problems, including social anxiety, depression, loneliness, fatigue, and low self-esteem (Jonas Burén et al., 2023). IGD often coexists with various medical disorders, leading to multiple adverse effects, such as poor academic performance, poor sleep quality, anxiety and depression (Hao Li et al., 2022). Furthermore, IGD is linked to other addictions, such as substance use (Julie Giustiniani, 2022).

One of recent studies found that mental health is positively associated with role-playing games where excessive involvement in it induces depression, anxiety, insomnia, and social withdrawal (Raith et al., 2021). However, the research contradicts a study conducted where engagement in a role-playing game has zero associations with signs of psychopathology. In fact, they demonstrated significant evidence with the game 'Dungeons & Dragons (D&D)' that concludes that having knowledge of the specific game itself reduces the chances of mental problems (Baker et al., 2023). This is supported based on research by Arenas et al. (2022), where role-playing games (RPG) are also used as therapeutic tools that aid in therapies such as psychotherapies and cognitive behavior therapy (CBT) which focuses on depression.

Violent games: Impact on Mental Health

Video games and the development of depression in a research on media exposures and depression among teenagers in the United States found no correlation by Primack et al. (2009). The relationship between video gaming and the mental health state has only been investigated in one research. The amount of time American teenagers, particularly those between the ages of 11 and 14, spend playing violent video games every day is rising, thus it is critical to find out if playing violent video games is associated with depression. (Susan R. & others, 2014; Mingchen Wei et al., 2022)

2.4.1 Mental health: Depression

Although mindfulness meditation provides a slight advantage for stress reduction, video games share the same principal in stress reduction (Veeral Desai et al., 2021). In addition, it helps alleviate student depression as stress in terms of family and study plays a significant role in exacerbating feelings of

hopelessness, sadness, and anxiety, contributing to the development and persistence of depressive symptoms (Yuwei Deng et al., 2022).

Additionally, playing video games is effective in treating depression (Marta Ruiz et al., 2022; Magdalena Kowal et al., 2021). However, this treatment method is not suitable for everyone, while playing video games helps reduce depression in the short term, it will increase the level of depression for individuals with avoidant coping styles in the long term (Federica Pallavicini et al., 2022). Furthermore, playing games for a long duration can decrease sleep quality (Emin Altintas et al., 2019), while sleep quality can act as a mediator between online games and depression (Caijun Dai et al., 2019; João Dinis et al., 2018). Traditional thinking holds that gambling addiction leads to depression. However, several studies have pointed out that the opposite may be true: people with depression are more likely to become addicted to gaming. (Zhaojun Teng et al., 2021; Ryan V. Labana et al., 2020).

2.4.2 Mental health: Anxiety

The most prevalent mental illnesses are anxiety disorders (Borwin Bandelow & Sophie Michaelis, 2022). Restlessness, feeling tense or agitated, easily becoming tired, having trouble focusing or losing one's train of thought, impatience, tense muscles, and irritability are all linked to anxiety. According to (Adwas et al., 2019), the causes of anxiety can include stress, physical health problems, genetics, and environmental factors. There is a link between social anxiety and online gaming addiction in adolescents (Jin Liang Wang et al., 2019). Social anxiety has also been linked to addiction to online games, smartphones, and the Internet (Kuss, Billieux, & Pontes, 2016). Anxiety and addiction are interdependent (Dalbudak et al., 2014).

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According to (Russell Pine et al., 2020), playing video games can also help reduce stress and anxiety levels. Computer games include a variety of scenarios that elicit good feelings (Daniela Villani et al., 2018). People search for and are more ready to purchase games that evoke good feelings (such as happiness and surprise) and enjoyment, which is one of the most often stated reasons for playing current video games (Hsuan-Yi Chou, 2016). Similar to other forms of entertainment, video games let people temporarily escape negative situations or feelings in the real world, which helps people avoid unpleasant emotions such as tension and anxiety (Michelle Colder Carras et al., 2018).

For social anxiety, POSI (Preference for Online Social Interaction) and 4 motives (escape, coping, fantasy, and recreation) of playing online games can cause social anxiety (Claudia Marino et al., 2020). Therefore, it is significant, as the individuals contain the urge to escape the real world, as the virtual world provides an accommodating space for their behaviors. A study also showed that RPGs help people with social anxiety to feel more relaxed showing their true self in virtual reality (Chen et al., 2020).

2.4.3 Mental health: Sleeping Disorder

Sleep disorders (or sleep-wake disorders) involve problems with quality, timing, and amount of sleep, resulting in daytime distress and impairment in functioning (Felix Torres et al., 2020). According to Aga Khan Hospital (2014), some general types of sleep disorders include respiratory problems related to sleep, movement disorders, insomnia, diseases of excessive drowsiness, aberrant sleep-wake patterns (circadian rhythm disorders), and abnormal behavior during sleep (parasomnias).

Sleep is essential for health. Healthy sleep is crucial for our mental health and physical restoration (Kannan Ramar et al., 2021). Diseases that adversely affect sleep can lead to functional impairment, poor health, and even death (Goran Medic et al., 2017). Sleep deprivation has been shown to increase the chance of early death. According to a recent analysis of many polls, those who slept fewer than six hours each night were 10 times more likely to die before their time than people who slept for seven or nine hours (Troxel et al., 2017).

As an increase in gaming levels along with rising rates of sleep problems (Stle Pallesen et al., 2014). It suggests that understanding the sleep characteristics of problematic gamers could shed light on this phenomenon, given the similarities in negative outcomes observed in both groups, such as depression and poor academic achievement. Several mechanisms are proposed for how gaming can impact sleep, including direct displacement of sleep due to gaming engagement (Liese Exelmans & Jan Van den Bulck, 2017), arousal from social interactions and game features, and the influence of screen-emitted blue light on sleep regulation (Front Physiol. 2022). Additionally, physical discomfort from prolonged gaming and exposure to electromagnetic fields from gaming devices may contribute to sleep disturbances (Joakim H. Kristensen et al., 2021).

2.5 Mediators

Research has shed light on how various aspects of technology use can lead to negative outcomes through different mediating factors. For example, studies have shown that addiction to online games can negatively impact academic performance, learning engagement acting as a bridge between the two (Sun et al., 2023). Similarly, excessive use of technological devices is linked to poor academic performance, mediated by disrupted sleep quality (Saray Ramírez et al., 2021). This pattern extends to other areas - problematic gaming is associated with psychological distress, with poor sleep quality again playing a mediating role (Qian Wang et al., 2021).

Additionally, the impact of technology continues to extend beyond academic performance. Studies suggest a link between problematic gaming and psychological problems such as stress and anxiety. Interestingly, the coping mechanism of playing video games appears to be a mediating factor in this relationship (Plante et al., 2018). Furthermore, research by Moge et al. (2020) indicates that low levels of offline social support (PSS) mediate the connection between online game addiction and depression, with similar findings for video game engagement and depression.

The reach of technology's influence does not stop there. Research suggests a connection between increased gaming time and poorer physical health, with a decrease in physical activity acting as a mediator (Joanne DiFrancisco-Donoghue et al., 2022). Interestingly, coping mechanisms seem to play a dual role. Studies have found that coping mediates the relationship between online game addiction and video game participation with negative mental health outcomes such as depression, anxiety, and stress (Clara E. Moge et al., 2020).

Social networks also appear to play a part in mental health. Research suggests a link between social media use and depression, but, interestingly, social support acts as a mediator in this case (H. Erin Lee et al., 2018). Furthermore, the research by Zhang et al. (2022) indicates that perceived academic stress contributes to depression, with both mobile phone addiction and sleep quality acting as mediators.

Finally, studies have explored the connection between online game disorder and negative outcomes. Research by Fazeli et al. (2020) suggests a link between online game disorder and both insomnia and lower quality of life, with depression, anxiety, and stress (DAS) acting as mediator. Table 1 summarizes the related mediators in this section.

Table 1. Summary of Related Mediators

IV	Mediator	DV	Resources
Online game addiction	Learning engagement	Academic achievement	Sun et al., 2023
Usage of technological devices	Sleeping quality		Ramírez et al, 2021

problematic gaming		Psychological distress	Wang et al, 2021
	Coping	Psychological Functioning (Mental health)	Juliane M. von der Heiden et al, 2019
	Emotional regulation		
	Social interaction		
Stress	Using video games as a coping mechanism	Game Addiction	Plante, Courtney N. et al, 2018
Anxiety			
Gaming time	Less physical activity	Physical health	Joanne DiFrancisco-Donoghue et al, 2022
Online game addiction	Coping	DAS	Clara E. Moga et al, 2020
	Low offline PSS.	Depression	
Video game engagement	Coping	DAS	
	Low offline PSS.	Depression Stress	
Depression	FOMO	PSU	Guangzhe Yuan,2021
Health anxiety		Gaming Disorder	Jon D. Elhai, 2020
Perceived academic stress	mobile phone addiction	Depression	Zhang et al, 2022
	Sleep quality		Zhang et al, 2022
Social Media	social support		H. Erin Lee et al, 2018
Online Game Disorder	DAS	Insomnia	Sara Fazeli et al, 2020
Online Game Disorder	DAS	life quality	Sara Fazeli et al, 2020

Note: DAS (Depression, Anxiety, Stress), PSS (Positive social support), FOMO (Fear of missing out), PSU (Problematic smartphone use)

2.6 Conceptual framework

Based on Figure 1, it shows the conceptual framework of our research. Mental health, mainly depression, anxiety, and sleeping disorder, acts as a mediator between the relationships of genres of games and academic performance as well as physical health. The video games we choose are Role-Playing Games (RPG) and violent games, acting as our independent variable while academic performance and physical health act as our dependent variable.

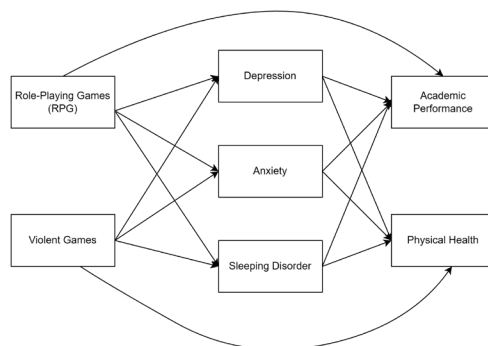


Figure 1. Conceptual Framework

The hypotheses based on the conceptual framework are as follows.

H1: There is a significant mediating effect of depression in the relationship between role-playing games (RPGs) and academic performance.

- H2: There is a significant mediating effect of depression on the relationship between Role-Playing Games (RPG) and physical health.
- H3: There is a significant mediating effect of depression in the relationship between violent games and academic performance.
- H4: There is a significant mediating effect of depression in the relationship between violent games and physical health.
- H5: There is a significant mediating effect of anxiety in the relationship between role-playing games (RPG) and academic performance.
- H6: There is a significant mediating effect of anxiety in the relationship between role-playing games (RPG) and physical health.
- H7: There is a significant mediating effect of anxiety in the relationship between violent games and academic performance.
- H8: There is a significant mediating effect of anxiety in the relationship between violent games and physical health.
- H9: There is a significant mediating effect of sleep disorder in the relationship between role-playing games (RPG) and academic performance.
- H10: There is a significant mediating effect of sleep disorder in the relationship between role-playing games (RPGs) and physical health.
- H11: There is a significant mediating effect of sleeping disorder in the relationship between violent games and academic performance.
- H12: There is a significant mediating effect of sleeping disorder in the relationship between violent games and physical health.
- H13: There is a significant relationship between role-playing games (RPG) and academic performance.
- H14: There is a significant relationship between role-playing games (RPG) and physical health.
- H15: There is a significant relationship between role-playing games (RPG) and anxiety.
- H16: There is a significant relationship between role-playing games (RPG) and sleeping disorders .
- H17: There is a significant relationship between role-playing games (RPG) and depression.
- H18: There is a significant relationship between violent games and academic performance.
- H19: There is a significant relationship between violent games and physical health.
- H20: There is a significant relationship between violent games and anxiety.
- H21: There is a significant relationship between violent games and sleeping disorders.
- H22: There is a significant relationship between violent games and depression.
- H23: There is a significant relationship between anxiety and academic performance.
- H24: There is a significant relationship between anxiety and physical health.
- H25: There is a significant relationship between depression and academic performance.
- H26: There is a significant relationship between depression and physical health.
- H27: There is a significant relationship between sleep disorder and academic performance.
- H28: There is a significant relationship between sleep disorder and physical health.

3.0 RESEARCH METHODOLOGY

Population and Sampling Procedure

This study included university students from Malaysia. The reason for selecting them as the target demographic is to focus on the impact of mental health through video games among university students. The data involved students from different education levels; foundation, diploma, undergraduate and postgraduate in which they were enrolled. In this study, the age of below 18 to more than 24 years in Malaysia constituted the population. In this investigation a simple random sampling method (SRS) was implemented. The distribution of current education levels comprises 40 pre-universities, 57 diplomas, 180 undergraduates and 25 postgraduates, which totals around 302 university students.

Data Collection

In order to explore the impact of video games towards university students in Malaysia, this research uses an online platform.

questionnaire as a method to collect data so that there is no restriction on where the respondents are. The online questionnaire is designed significantly to focus university students as our target demographic. The questionnaire is shared physically but mainly online through social media including WhatsApp, Xiaohongshu, Instagram, Facebook, Messenger, WeChat, and Discord to ease the participation of university students. Data were collected from the 5th of March until 31st of March 2024.

The questionnaire comprises four sections, including the first section. The first section includes the demographics of the participants. The second to the last section includes questions related to mental health where it follows the corresponding order; depression, anxiety, and sleeping disorder. Questions about depression were referenced from PHQ-9 (Patient Health Questionnaire-9) and questions about anxiety were referenced from GAD-7 (Generalized Anxiety Disorder 7-item scale). The questions to determine sleep disorder were from questionnaires created by the Alberta Medical Association.

The structure for the questions is designed using multiple-choice grids. It allows the respondents. Section B offers 2 rows of the main genre of video games which are Role-Playing Games (RPG) and Violent games accompanied by a scale of 1 to 5 that determines the number of hours played in the game namely (1 - None, 2 - <1 Hour, 3 - 1 to 3 Hours, 4 - 4 to 7 Hours, 5 - 8 Hours). This differs from Section C and Section D where it is measured according to the scale ranging from 1 to 4 namely (1 - Not at all, 2 - Several days, 3 - More than half of the days, 4 - Nearly every day). However, Section E introduces an extra option, adjusting the scale where it ranges from 1 to 5 namely (1 - Never, 2 - Rarely, 3 - Occasionally, 4 - Most Nights/Days, 5 - Always).

Analysis

Data were analyzed using SPSS version 26. The Cronbach alpha test was conducted to test the reliability of the questionnaire items. H1 until H12 performed mediating analysis using Process Macro. H13 until H28, except **H14**, **H19**, **H24**, **H26** and **H28**, were verified through Pearson correlation, whereas the excluded hypothesis was Chi Square.

4.0 RESULTS AND DISCUSSIONS

4.1 Reliability Analysis

The Cronbach Alpha test is conducted to test the reliability of the questionnaire, as shown in Table 3. The reliability levels for demographics and games individually are poor (0.5-0.59) and acceptable (0.7-0.79). The reliability level for mental health measurements is excellent (>0.9). Overall, the reliability level for all the questionnaire items are 0.737 which are acceptable (0.7-0.79).

Table 3. Reliability level of the Questionnaire item

Questionnaire items section	Cronbach's Alpha	Number of items
Demographics	0.539	3
Games	0.711	2
Depression Measurement	0.908	9
Anxiety Measurement	0.919	7
Sleep Disorder Measurement	0.915	16
Overall	0.737	37

4.2 Demographics

As shown in Table 4, a total of 302 university students participated in this study, with 18.87% holding diplomas (Advanced Diplomas, Certificates, or equivalent), 8.28% holding postgraduate degrees (Masters or PhDs), 13.25% having pre-university qualifications (such as A-Levels, Matriculation, Foundation, or STPM), and the majority, 59.60%, having Undergraduate degrees (Bachelor's or Professional Qualifications such as ACCA, CPA, CIA, etc.). With 302 participants who participated in the study, 43.38% are female respondents, while 56.62% are male. In terms of age distribution, 1.98% were 18 or below, 86.75% fell within the age bracket, and 11.26% were 24 years old.

Table 4. Demographics of the participants

		Frequency	Percentage
Gender	Male	171	56.62%
	Female	131	43.38%
Age	≤ 18	6	1.98%
	19-23	262	86.75%
	≥24	34	11.26%
BMI	<18.5	83	27.485
	18.5-24.9	180	59.60%
	25.0-29.9	30	9.935
	>30.0	39	12.91%
CGPA	0.00-2.00	2	0.66%
	2.01-2.50	4	1.32%
	2.51-2.74	7	2.32%
	2.75-3.50	77	25.50%
	3.51-3.74	95	31.46%
	3.75-4.00	104	34.44%
	N/A	13	4.30%
Education Level	Diploma (Advanced Diploma, Certificates or equivalent)	57	18.87%
	Postgraduate (Master, PhD)	25	8.28%
	Pre-university (A-level, Matriculation, Foundation, STPM)	40	13.25%
	Undergraduate (Bachelor/ Professional Qualification - [ACCA, CPA, CIA etc])	180	59.60%
TOTAL:		302	

Pattern of RPGs and Violent Games Based on Demographic

Based on Figure 2, it distributes students across different educational levels based on the amount of time they spend playing RPG games in a week. Figure 2 shows that most of the pre-university students are not playing RPG games in a week, which is 37.5%. Conversely, most of the postgraduate students spend 1-3 hours playing RPG games, which is 52%. Furthermore, the highest average time spent playing games among students at different educational levels is 1-3 hours. Based on Figure 3,

it distributes students across different educational levels based on the amount of time they spend playing violent video games in a week. Figure 3 shows that most pre-university students are not playing violent games in a week, which is 52.5%. Conversely, most postgraduate students spend 1-3 hours playing violent games, which is 52.0%. Furthermore, the highest average time spent playing games among students at different educational levels is not playing violent games. These data suggest that post-graduate students tend to dedicate more time to RPG games and violent video games compared to other groups. Preuniversity students appear to have the least amount of time spent on RPG games and violent video games, with a majority not playing at all.

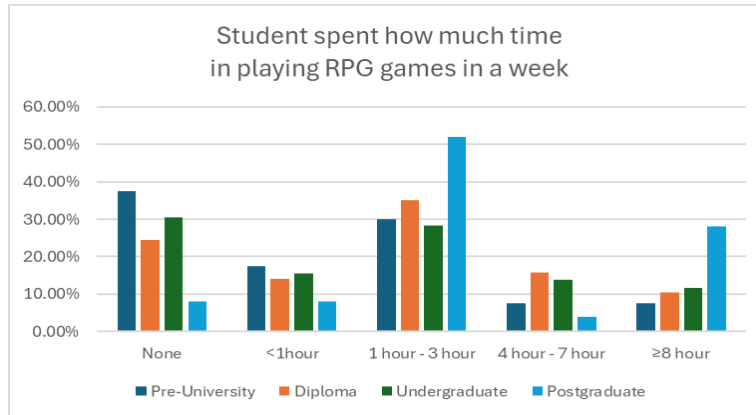


Figure 2. Students at different education level spending how much time in playing RPG games in a week

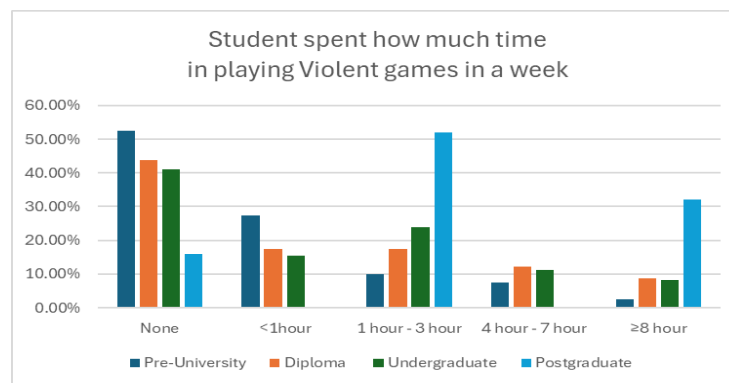


Figure 3. Students in different levels of education spend how much time in playing violent games in a week.

Mental Health Demographics

Based on Figure 4, depression severity levels among participants were distributed as follows: 23 people (7.62%) reported no depression, 63 (20.86%) had minimal depression (1-4 range), 98 (32.45%) had mild depression (5-9 range), 64 (21.19%) experienced moderate depression (10-14 range), 30 (9.93%) reported moderately severe depression (15-19 range) and 24 (7.95%) had severe depression (20-27 range), totaling 302 participants in the analysis.

The of anxiety of severity levels among participants were as follows: 124 individuals exhibited minimal anxiety (0-4 range), 84 showed mild anxiety (5-9 range), 63 experienced moderate anxiety (10-14 range) and 31 had severe anxiety (15-21 range), with a total of 302 participants included in the analysis.

The severity levels among participants were distributed as follows: 152 individuals (50.33%) exhibited minimal sleep disorder (0-12 range), 86 (28.48%) showed mild sleep disorder (13-24 range), 38 (12.58%) experienced moderate sleep disorder (25-36 range), 7 (2.32%) had moderately severe sleep disorder (37-48 range) and 19 (6.29%) had severe sleep disorder (49-64 range). This represented a total of 302 participants in the analysis, with percentages totaling 100%.

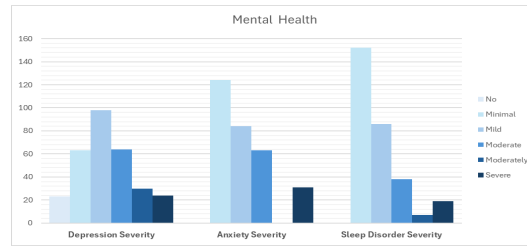


Figure 4. Severity of Mental Health among University Students in Malaysia

4.3 Hypothesis analysis

Based on Table 5, the p value for violent game duration and the level of anxiety level is 0.000, which below 0.05, with correlation 0.205, this shows a positive relationship between RPG game duration and anxiety level; therefore, we accept **H15**. The study also revealed the positive relationship between the duration of the RPG game and sleeping disorder level with a value of p value = 0.004 , correlation = 0.164, indicating that **H16** is true and acceptable. Meanwhile, the duration of the the duration of the RPG game also has a positive relationship with the level of depression, with p = 0.000 and correlation = 0.261, therefore **H17** is accepted. Meanwhile, the relationship between violent games and BMI is positive (chi-square value = 21.492*) and significant (p = 0.044 <= 0.05), this indicates that **H19** is also true and acceptable. Furthermore, the p value for the duration of violent games and anxiety is 0.000, which is below 0.05, with correlation 0.249, which shows a positive relationship between violent game duration and anxiety level, therefore we accept **H20**. The study also revealed a positive relationship between the duration of violent games and sleeping disorder level with the p value = 0.001 , correlation = 0.198, which indicates **H21** is true and acceptable. Meanwhile, RPG game duration also has a positive relationship with the level of depression, with p = 0.000 and correlation = 0.291; therefore, **H22** is accepted. In addition to that, anxiety shows a significant positive relationship with BMI (physical health), with chi-square value of 26.661 and a p value of 0.032 (p <= 0.05), therefore, **H24** is accepted.

Table 5. Pearson correlation between RPG games, Violent games, depression, anxiety, sleep disorder, CGPA and Chi square for BMI

	Depression	Anxiety	Sleep Disorder	CGPA	BMI
RPG Games					
Pearson’s Correlation	.261***	.205***	.164*	.012	-
Chi Square	-	-	-	-	15.857
Sig. (2-tailed)	.000	.000	.004	.830	.198
Violent Games					
Pearson’s Correlation	.291***	.249***	.198***	.047	-
Chi Square	-	-	-	-	21.492*
Sig. (2-tailed)	.000	.000	.001	.416	.044
Depression					
Pearson’s Correlation	-	-	-	.020	-
Chi Square	-	-	-	-	8.835
Sig. (2-tailed)	-	-	-	.729	.453
Anxiety					
Pearson’s Correlation	-	-	-	.048	-
Chi Square	-	-	-	-	26.661*
Sig. (2-tailed)	-	-	-	.410	.032
Sleep disorder					
Pearson’s Correlation	-	-	-	.021	-
Chi Square	-	-	-	-	6.134
Sig. (2-tailed)	-	-	-	.717	.909

Note: $p < 0.05$, $**p < 0.01$, $***p < 0.001$

4.4 Mediation Analysis

Based on Table 6, depression, anxiety, and sleep disorder show no mediating effect ($p \geq 0.05$) between RPG and academic performance, RPG and Physical Health, Violent Games and Academic Performance, Violent Games and physical health. Therefore, we reject **H1, H2, H3, H4, H5, and H6**.

Table 6. Mediator analysis

	Depression	Anxiety	Sleep Disorder
RPG Games → Academic performance			
DE	.261	.205	.164
IE (BootLLCI, BootULCI)	.0049 (-.0235, .0350)	.0101 (-.1182, .1239)	.0033 (-.0125, .0252)
RPG Games → Physical Health			
DE	.261	.205	.164
IE (BootLLCI, BootULCI)	-.0125(-.0301, .0024)	-.0065(-.0180, .0777)	-.0020 (-.0223, .0729)
Violent Games → Academic performance			
DE	.0485	.0404	.0481
IE (BootLLCI, BootULCI)	.0022 (-.0301, .0355)	.1030(-.0183, .0420)	.0026 (-.0166, .0275)
Violent Games → Physical Health			
DE	.0105	.0049	-0.003
IE (BootLLCI, BootULCI)	-.0125(-.0324, .0047)	-.0069(-.0229, .0076)	-.0016(-.0155, .0084)

Note: $p < 0.05$, $**p < 0.01$, $***p < 0.001$

4.5 DISCUSSION

Video Games

Malaysian video game industry, with a projected CAGR of 10.9% and a market volume expected to reach US\$168 million by 2023. This indicates a strong and growing interest in video games within the Malaysian population (The Malaysia Reserve, 2024). Statista's market forecast predicts an expansion of the user base within the Malaysian video game market, reaching 7.0 million users by 2027. This further emphasizes the increasing popularity of video games (Statista Market Forecast, n.d.). Based on Statista data (Umair Bashir, 2024), that shows the student spending 1-5 hours is the most people willing to spend playing games, which is 27% and the following are spending 6-8 hours which is 18%. But in our analysis in Figures 2 and Figure 3, we can see that the highest average that students at different education levels spend time playing video games is not playing games and 1-3 hours in a week. The reason behind our analysis may be that students in these education levels are busy with studies because they focus more on their academics compared to spending time on playing video games. Besides, based on research of Front Psychol (2023), studies indicate, when related to time perspective, that future orientation has a positive relationship with higher academic levels. Postgraduate students might have more flexible time compared to students at lower educational levels. This could be due to potentially less demanding coursework, fewer required classes, or a more flexible academic schedule. With more flexible time, post-graduate students might have a larger window for leisure activities like gaming, potentially falling within the 1-3 hour playtime range.

Hence, more research is required to explore the complex relationships between the education level of a student and the amount of time in playing games.

The main limitation of the study includes the generalizability of the results, as factors like the intensity of gameplay, social interaction within games, or even the context in which it involves sitting, standing, or even moving have not been taken into consideration. In addition to the factors mentioned, it is important to acknowledge the potential confounding variables such as lifestyle factors, family dynamics, and socioeconomic status as these might influence the results.

Video Games on Mental Health

In our study, both RPG players and violent gamers have higher levels of depression, anxiety, and sleep disorder. For sleep disorders, our study revealed that longer gaming durations can cause lower sleeping quality. This aligns with previous research (Pietro Muratori et al., 2023). This is due to the increased use and reduced sleep duration. Each additional hour of tablet use is associated with 15.6 minutes less total sleep (Celeste H. M. Cheung et al, 2017). This finding highlights the relevance of scheduling video game playtime. Pre-sleep habits significantly impact teenagers' sleep quality (Sonia Chindamo et al., 2019). Likewise, research demonstrates strong correlations between time spent playing video games just before bed and the occurrence of sleep disorders (Jasper Wolfe et al., 2014).

For depression, our study revealed that longer games are positively associated with depression level. This aligns with previous research (Zhaojun Teng et al., 2021). This may be related to the sleep disorder we discuss above, where depression is linked to both a reduction in deep sleep (slow wave sleep) and heightened alertness at night (arousal). These study participants acknowledged that neglecting sleep due to ignoring fatigue caused by excessive online gaming can contribute to depressive symptoms (Caijun Dai et al., 2019; João Dinis et al). However, there is a possibility that people with depression are more likely to get gaming addiction (Zhaojun Teng et al, 2021; Ryan V. Labana et al, 2020). But some research shows that casual gaming is effective in treating depression (Marta Ruiz et al, 2022; Magdalena Kowal et al., 2021).

For anxiety, POSI (Preference for Online Social Interaction) and 4 motives (escape, coping, fantasy, and recreation) of playing online games can cause social anxiety (Claudia Marino et al., 2020). Therefore, it is significant, as this might be due to individuals containing the urge to escape the real world, as the virtual world provides an accommodating space for their behaviors. RPGs help people with social anxiety to feel more relaxed showing their true self in virtual reality (Chen et al., 2020).

In our study, violent games and RPG games are both positively associated with mental health (anxiety, sleep disorder, and depression). However, their effects on mental health differ from each other in terms of effect strength. The average increase in anxiety level, sleeping disorder level, and depression level in violent games are all higher than in RPG games, which means playing RPG games may have a healthier impact compared to violent games. One of the possible reasons behind this is the mechanism of video game addiction that varies between game types (Jinyu Guan et al, 2022).

The main limitation of the study includes the generalizability of the results, as factors such as intensity of gameplay, social interaction within games, or even the context in which it involves sitting or standing have not been taken into consideration. In addition to the factors mentioned, it is important to acknowledge the potential confounding variables such as lifestyle factors, family dynamics, and socioeconomic status as these might influence the final results.

Video Games on Physical Health

In our study, role-playing games (RPGs) are not associated with poor physical health, whereas violent games do. This may be supported when the findings of an article show that food insecurity is one of the reasons that leads to an increased number of days with poor physical health among university students ($P < 0.0001$) (Hagedorn et al., 2021). Furthermore, fitness role-playing games (RPGs) such as Shikudo Inc, increased the level of physical activity level and induced motivation to learn their exercise content (Zulkifli & Danis, 2022).

Since physical activity was significantly related to life satisfaction (Urchaga et al., 2020), in contrast to role-playing games, life satisfaction was found to be lower when 20.6% of the participants saw violent content on purpose and agreed that video games could make them violent (Ramírez et al., 2021).

One research indicates that engaging in video games is negatively associated with physical activity, especially among undergraduate men (Puolitaival et al., 2020). In fact, it aligns with our study which shows that playing video games will have higher sedentary time ($p < 0.001$) which may lead to possible poor physical health (Cabanas-Sánchez et al., 2020). Another biased yet high-risk study reported only descriptive statistics where 40% of video gamers does not engage in any variety of physical activity (DiFrancisco Donoghue et al., 2019). In comparison, a study with low risk of bias showcased zero correlation between video games and sedentary behavior (Rudolf et al., 2020). For instance, the preliminary results of the research evidently show that 73% of eSports players meet the physical activity criteria potentially because of their main motive, which is to stay healthy and improve their physical capacity. Unlike class video games or other screen-based activities, it requires the participation of participants to move their bodies to progress (Pelletier et al., 2020). Apart from that, a study conducted in Hong Kong rejected our hypothesis by indicating that high-intensity gaming is associated with lower levels of physical activity (Kwok et al., 2021).

Video Games on Academic Performance

In our study, the duration of video games is not associated with academic performance. This is aligned with (Kwok et al., 2021) research. In fact, in our study, the academic performance is slightly better than that of non-players, this may be because even though some research found that online game disorder can affect IQ (Jon Hwan Jang et al, 2021) and academic performance (Kwok et al., 2021), a limitation is within our study : the duration that we are using in this study as the independent variable may not have a linear relationship with the gaming disorder . In fact, the study shows that to show an effect on the gaming disorder, a person needs to use more than half of his total free time for his total free time or more than 20 hours gaming time for a week, while moderate players are not affected (Braz. J. Psychiatr et al., 2020). Also a study shows that moderate players can get better academic performance (Dr. Fernando Gómez-Gonzalvo et al., 2020). This means game duration may not be linearly associated with gaming disorder, but only heavy gaming duration is associated with gaming disorder that can cause low IQ (Joon Hwan Jang et al., 2021) and academic performance (Kwok et al., 2021). Additionally, there is a possibility that academic performance can avoid gaming disorders (Nazir Hawi et al, 2024), however there is no sufficient evidence to support this statement.

Mental Health on Academic Performance and Physical Health

Our study examined the relationship between mental health, which is depression, anxiety, and sleep disorder, and both academic performance and physical health. In our result, contrary to our initial hypotheses, our analysis revealed that there was no significant correlation between mental health and both academic performance and physical health, except for anxiety. On the contrary, anxiety is shown to be significant for physical health.

One of the possible reasons is the bias of data collection. There is a bias in which the data that are obtained mainly originate from university students who face relatively less mental health problems. Based on Figure 4, we can categorize individuals with scores falling within the ranges of "no", "minimal," and "mild" as experiencing fewer mental health problems. On the contrary, those who fall within the ranges of "moderate," "moderately severe" and "severe" can be categorized as experiencing more serious mental health issues. Furthermore, it should be noted that the categories representing fewer mental health issues collectively represent a significant portion of the data. Specifically, these categories encompass 61% of the total of respondents for depression, 69% for anxiety, and 79% for sleep disorders. This highlights the prevalence of milder mental health concerns within the sampled population. Another possible reason for the result is academic performance and physical health are influenced by a multitude of factors beyond mental health alone. Socioeconomic status, access to healthcare, lifestyle choices, genetics, and environmental factors all play a significant

role in shaping these outcomes. Therefore, the impact of mental health on academic and physical health can be diluted or overshadowed by other influential factors.

It is also important to consider the limitations of measurement tools and methodologies used to assess mental health, academic performance, and physical health. Variability in assessment instruments, sample characteristics, and data collection methods may contribute to inconsistent findings and obscure true relationships between variables. In short, the relationship between video games, mental health, academic performance, and physical health is complex and multifaceted. While mental health undoubtedly plays a critical role in overall well-being, its impact on specific outcomes may be nuanced and influenced by a myriad of individual and contextual factors. More research is needed to better understand the interaction between mental health and other aspects of human functioning.

Discussion of mediating analysis

The mediators in our study include levels of anxiety, depression, and sleep disorder. Although gaming is associated with poor mental health, it was insignificant for academic performance and physical health. Basically, the mediating role of mental health is insignificant for video games and academic performance, as well as physical health.

The role of mental health as a mediating effect towards physical health is insignificant. Physical activity could be a possible mediator as one study found that a group of college esports players was significantly less active (1.7 ± 1.9 days/week; 39.5 ± 40.4 min/day) and led to a higher body mass index (BMI) (23.7 ± 3.3) that is considered overweight. Furthermore, the lack of engagement in physical activity was mainly associated with their beliefs about improving their gaming performance (DiFrancisco Donoghue et al., 2022). Interestingly, Rudolf et al. (2020) showed similar findings.

In terms of mental well-being, another study found that depression, stress, and anxiety (DAS) mediates the associations between internet gaming disorder and insomnia (Fazeli et al., 2020). It may be similar, as social interaction and emotional regulation may play a role for gamers who preferred role-playing games, one study concluded that video gamers are more likely to be shy and have a lower self-esteem, which is reported to have fewer offline connections (Von Der Heiden et al., 2019).

One of the reasons behind the relationship between the insignificance of mental health and academic performance is the engagement with learning. Learning engagement may be the main mediator for video game addiction and academic performances as it negatively affects their emotional, behavioral, and cognitive engagement, which in turn affects their academic achievements. In other words, learning engagement is the sense of motivation to participate academically, students who have a low learning engagement will have a poor academic performance. (Sun et al., 2023). Interestingly, a study suggested that sleep deprivation had a mediating effect between the usage of technological devices and academic achievements. With evidence, it shows that students who had fewer than 8 hours of sleep are exposed to higher chances of a lower GPA (Ramrez et al., 2021). However, the study did not take into account the genre of games which are RPG and Violent games but did question whether the participants are purposely exposed to violent content. In fact, our study presented that the mediating effect of sleeping disorders had an insignificant relationship with academic performance ($p > 0.05$) but a significant effect with both genres of games ($p < 0.05$). In particular, our study had a small sample size ($N = 302$) compared to Ramirez et al. (2021) ($N = 2440$) and the lack of additional confounding factors such as cyberbullying and indicators of addiction to video games. Therefore, more research is required to explore the complex relationships between sleep, gaming behavior, and academic performances.

Importantly, there were limitations in this study that were measurement problems. Physical health was mainly measured using categorical values, which were calculating body mass index (BMI) and categorizing them. Mediating analysis which was conducted in Process Macro requires the variables to be numerical; hence physical health had an invalid and unreliable result. Therefore, more research is required to address these findings.

Additional Analysis: Anova Analysis on Physical Health

H19: There is a significant relationship between violent games and physical health.

On the basis of the analysis of Chi-square, the sig. for **H19** is significant at .007 and therefore H19 is not rejected if the analysis is also conducted in a one-way Anova. This could be due to long hours of engagement with video game participation, sleeping quality will be greatly impacted (Emin Altintas et al., 2019), while bad sleeping quality can lead to higher BMI (Giovanna Muscogiuri et al, 2020). In addition to that, lack of physical activity might be one of the factors, while a longer duration can cause low levels of physical activity (Kwok et al., 2021).

5.0 CONCLUSIONS

In conclusion, this study has investigated the relationship between RPG and violent video games, mental health, academic performance, and physical health among university students. By highlighting the mediating effect of mental health, our findings show that mental health does not play a role in affecting video games and academic performance or physical health. In addition to that, our study found that video games, especially RPGs and violent video games, showed a significant impact on mental health at around $p < 0.01$. It is clear that video games play a significant impact on mental health, which in turn does not affect physical health and academic performance. However, university students may have other factors that are not taken into account that affect academic performance and physical health, such as food insecurity, poor learning engagement, issues of attachment towards technology, sedentary behavior, and much more to be discussed for future researchers.

From the above research, the main limitation of the study as previously mentioned is the inability to generalize findings, as it overlooks gaming settings and context as well as demographic factors that could potentially provide a significant impact towards our result. Future research should aim to address these limitations by incorporating more diverse and representative samples, using longitudinal designs to explore causal relationships, and considering contextual variables that can influence the observed associations. It is also interesting to explore the difference between countries, as convenient sampling was used only in Malaysian tertiary institutions.

Despite these limitations, the question has arisen: Does the impact vary across different genres of video games? This highlights the importance of further investigation, as video games contain a wide range of categories that are favored by different populations and demographics. Although there is a lot of research surrounding video games with different demographics, it is best to understand that students represent a key audience that engages with video games from a young age, especially in the years to come. This will be informative and act as a blueprint for policy makers, video game creators, educators, and healthcare professionals in Malaysia.

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Appendix

Table A1. Questionnaire Details

Section	Questionnaire Item	Options
Demographic	Gender	Male/Female
	Age	
	Current GPA	3.75-4.00; 3.51-3.74; 2.75-3.50; 2.51-2.74; 2.01-2.50; 0.00-2.00; N/A
	Education Level	Pre-University (A-Level, Matriculation, Foundation, STPM); Diploma (Advanced Diploma, Certificates or equivalent); Undergraduate (Bachelor's/ Professional Qualification - [ACCA, CPA, CIA etc]); Postgraduate (Master, PhD);
	Height (cm)	
	Weight (kg)	
Video Games: In the past 1 week, how much hours do you spend in playing the following games?		
Role-Playing Games (RPG)		None; <1 hour; 1 hour - 3 hour; 4 hour - 7 hour; ≥8 hour
Violent Games		None; <1 hour; 1 hour - 3 hour; 4 hour - 7 hour; ≥8 hour
Depression: In the past 1 week, how do you feel?		
Little interest or pleasure in doing things		Not at all Several days More than half the days Nearly every day
Feeling down, depressed, or hopeless		
Trouble falling or staying asleep, or sleeping too much		
Feeling tired or having little energy		
Poor appetite or overeating		
Feeling bad about yourself or that you are a failure or have let yourself or your family down		
Trouble concentrating on things, such as reading the newspaper or watching television		
Moving or speaking so slowly that other people could have noticed. Or the opposite being so fidgety or restless that you have been moving around a lot more than usual		
Thoughts that you would be better off dead, or of hurting yourself		
Anxiety: In the past 1 week, how do you feel?		
Feeling nervous, anxious, or on edge		Not at all Several days More than half the days Nearly every day
Not being able to stop or control worrying		
Worrying too much about different things		
Trouble relaxing		
Being so restless that it is hard to sit still		
Becoming easily annoyed or irritable		
Feeling afraid, as if something awful might happen		
Sleeping Disorder: In the past 1 week, how do you feel?		
Do you have trouble falling asleep?		
Do you have trouble staying asleep?		
Do you take anything to help you sleep?		
Do you use alcohol to help you sleep?		

Do you have any medical conditions that disrupt your sleep?	<p style="text-align: center;"> Never Rarely Occasionally Most Nights/Days Always </p>
Have you lost interest in hobbies or activities?	
Do you feel sad, irritable, or hopeless?	
Do you feel nervous or worried?	
Do you think something is wrong with your body?	
Are you a shift worker or is your sleep schedule irregular?	
Are your legs restless and/or uncomfortable before bed?	
Have you been told that you are restless or that you kick your legs in your sleep?	
Do you have any unusual behaviours or movements during sleep?	
Do you snore?	
Has anyone said that you stop breathing, gasp, snort, or choke in your sleep?	
Do you have difficulty staying awake during the day?	