

IMPACT OF INTERNET USAGE AND VIDEO GAMING ON THE ACADEMIC PERFORMANCE OF POSTGRADUATE STUDENTS IN A PRESTIGIOUS TAIWANESE UNIVERSITY

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KeyWords

Academic performances, Analysis blueprint, Balanced lifestyle, Internet usage, Statistical analysis, Postgraduate students, Videogaming

ABSTRACT

The influence of technology usage on the growth and academic achievements of children, teenagers, and young adults is still a topic of ongoing discussion and debate. This study investigates the intricate relationship between internet usage, video gaming, and the academic performance of postgraduate students at a prestigious Taiwanese university. With a diverse sample of master's and Ph.D. students, research objectives guided a comprehensive analysis blueprint. According to the results, descriptive statistics provided nuanced insights into academic and lifestyle factors, revealing diverse engagement patterns in internet use and gaming. Correlation analyses explored relationships between Grade Point Average (GPA) and lifestyle factors, with modest associations noted, though statistical significance was not achieved. The regression model indicated that study hours, gaming hours, internet usage, and sleeping hours did not significantly predict GPA. The Chi-square test revealed a meaningful association between video game addiction and academic performance, emphasizing the need for further exploration. Friedman tests delved into negative impacts, coping mechanisms, and alternative leisure activities, offering valuable insights into students' experiences. Notably, female Ph.D. students exhibited a slightly higher GPA, and age-related variations in gaming habits were observed. These findings contribute to the discourse on digital well-being, shedding light on the multifaceted recreational landscape and academic challenges faced by postgraduate students. This study underscores the importance of addressing these concerns to foster balanced lifestyles and promote holistic well-being in the evolving digital landscape of postgraduate education.

1. Introduction

Adopting new technologies, including smartphones, computers, tablets, video game consoles, and internet access, has seen a significant and increasing prevalence, commencing at progressively younger ages each day (Almigbal et al., 2022; Islam et al., 2020; Najmi et al., 2023; Oliveira et al., 2017; Skoric et al., 2009; Wang et al., 2014). This surge in technology use has raised heightened concerns about its consequences and impact on children, adolescents, and young adults' emotional and cognitive development (Anderson et al., 2017; Ramirez et al., 2021). Smartphones have become versatile tools, allowing individuals to make calls, browse the Internet, engage in social networking on platforms such as YouTube, Instagram, Facebook, and Twitter, stay updated on news and weather, utilize instant messaging applications like Line/WhatsApp for text and voice communication, play video games, listen to music, view and share images, documents, videos, and emails, and shop online (Ghazanfar A. Abbasi et al., 2021). Globally, smartphones are recognized as essential components of human life, with existing literature underscoring their widespread use, particularly among students who consider smartphones among their top-preferred devices (Singh & Samah, 2018). In the academic realm, students rely on computers for research, writing papers, and accessing educational resources (Raza & Khan, 2022; Simões et al., 2022). Additionally, computers have become a preferred platform for video gaming among the youth, providing immersive and interactive experiences (Chan et al., 2022). Studies in the United States have reported that adolescents dedicate over 11 hours a day to modern electronic media, such as computers/internet and electronic games, surpassing the time spent in school or with friends (Paulus et al., 2018). In Australia, reports indicate that approximately 98% of children aged 15–17 are internet users, and 98% of adolescents engage in electronic games, significantly exceeding those reported in the USA and Europe (Islam et al., 2020; Posso, 2016; Ramirez et al., 2021; Ridders et al., 2016).

The impact of technology use on the development and academic performances of children, adolescents, and young elders remains a subject of debate (Gottschalk, 2019; Núñez-Pacheco et al., 2023; Oswald et al., 2020; Ramirez et al., 2021). A recent system-

atic review shows an association between technology use and unfavorable psychological effects (Oswald et al., 2020). A longitudinal study involving adolescents revealed a negative correlation between the hours spent on technological devices and life satisfaction, indicating that increased usage is linked to lower satisfaction levels (Babic et al., 2017). Furthermore, screen exposure has been connected to diminished cognitive and academic functioning, encompassing issues with attention, memory, learning, and visuospatial processing (Mundy et al., 2020; Vedeckina & Borgonovi, 2021). Nevertheless, there is supporting evidence indicating that excessive engagement in video game playing, particularly online gaming with continuous and potentially endless activity, can lead to addiction. This can potentially result in addiction for a small percentage of gamers (Ramirez et al., 2021). Numerous empirical and clinical studies consistently show that excessive Internet and video game usage may have adverse effects on various aspects of psychological development. This is particularly true for online video gaming, where the game's continuous nature without pauses or endings creates the potential for an activity that never concludes (Griffiths & Meredith, 2009). Dopamine serves as a neurotransmitter essential for the brain's reward system, as well as being instrumental in processes related to motivation and pleasure. In the context of video gaming and internet use among children, adolescents, and young adults, the relationship with dopamine is often linked to the rewarding nature of these activities (Arima & Latino, 2023; Tereshchenko, 2023). The escalating concern of gaming addiction is noteworthy, with a prevalence ranging from 2.0 to 3.1% among the global young population (Darvesh et al., 2020; Ramirez et al., 2021). Notably, the World Health Organization (WHO) has officially recognized Gaming Disorder in the 11th Revision of the International Classification of Diseases (ICD-11), characterizing it as a behavioral pattern marked by impaired control over gaming, leading to significant impairment in personal, family, or social functioning. This disorder has also been included in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) under the category Conditions for Further Study, referred to as Internet Gaming Disorder (IGD) (Association, 2018; Ramirez et al., 2021). Negative behaviors associated with video game addiction include impaired control over gaming time, prioritizing gaming over responsibilities, escaping reality through excessive gaming, withdrawal symptoms, social isolation, neglect of physical health, deterioration in academic or occupational performance, deceptive behavior, increased aggression, irritability, and neglect of personal hygiene (Alanko, 2023; Oliveira et al., 2022; Siddiqui et al., 2018; Singh, 2019). In addition, another significant issue associated with technology use is the disruptive impact on sleep patterns. Exposure to device light during the evening and night, especially when emotionally invested, has been linked to poorer sleep quality and reduced duration of sleep (Ramirez et al., 2021; Woods & Scott, 2016).

However, in recent times, the Internet and electronic games have been recognized as crucial not only for enhancing academic performance but also for facilitating self-expression, sociability, creativity, and entertainment for this demographic (Adžić et al., 2021; Islam et al., 2020). From an educational standpoint, video games can contribute to academic learning by alleviating stress, integrating technical game terminology into classroom content, and serving as a reward system for students (Al-Mansour, 2019; Hussain & Griffiths, 2008). Beyond formal learning, video games also foster non-academic skills in youths, especially students, such as problem-solving, decision-making, critical thinking, handling pressure, resilience in the face of challenges, and collaboration in teamwork (Adžić et al., 2021; Oliveira et al., 2017; Yu & Baxter, 2016). Moreover, Internet use and video games assist students in accomplishing various activities, including information sharing, chatting, making in-game purchases for additional features, learning, online browsing, and shopping, saving progress, and enhancing language skills associated with the game (Adžić et al., 2021; Li et al., 2018; Liao & Teng, 2017). For instance, in the USA, 88% of 12–17-year-olds perceive the Internet as a valuable tool for academic progress (Islam et al., 2020; Oliveira et al., 2017).

The inconclusive findings underscore the pressing need to comprehend the impact of Internet use and electronic gaming on the development of children and adolescents, particularly in their academic performance. Furthermore, technological devices have proven beneficial in facilitating learning processes, especially in the early stages of mathematics education (Gottschalk, 2019). Research indicates that among students with below-average reading skills, increased Internet use is correlated with improvements in those skills (Jackson et al., 2011). Another study demonstrated a positive association between playing computer games and enhanced scores on comprehension and applied problem tests in children (Hofferth & Moon, 2012). Likewise, the development of digital skills during early childhood is reported to have a significantly positive correlation with later school performance (Ramirez et al., 2021). Maintaining an optimal screen leisure time of 10 hours per week is highlighted (Hattie, 2008). Academic achievements tend to be lower when screen leisure time per week falls below or exceeds this recommended threshold. Adolescents achieve optimal academic performance when engaging in homework activities for 4 hours per day. A study showed that those at the extremes of the scale, who spend the least and the most time on reading and homework, exhibit lower academic performance. Gaming does not pose a threat to academic results if students allocate the suggested time of 4 hours per day to study (Adžić et al., 2021; Corder et al., 2015). Importantly, this balanced approach allows for leisure time and gaming, even during exam periods. A Grade Point Average (GPA) stands as the mean of all grade points attained by a student throughout their academic studies. It serves as a crucial metric, acting as one of the most significant indicators of success in college (Adžić et al., 2021).

In tackling these crucial concerns, our study sets out to unravel the intricate relationship between internet usage, electronic gaming, and the academic performance of postgraduate students—comprising both local and international participants pursuing master's and PhD degrees at a prestigious Taiwanese university. Our magnifying glass will be particularly focused on those enrolled in the Institute of Environmental Engineering and the Department of Chemistry. In this study, two primary objectives are outlined, each associated with specific variables and expected outcomes. The first objective aims to analyze the relationship between internet usage and academic performance, utilizing variables such as internet usage hours, video game playing hours, study hours, sleeping hours, and GPA. Descriptive analysis, correlation analysis, regression modeling, and the Friedman Test will be employed to discern the associations and model the intricate relationship between academic performance and lifestyle practices. The second objective seeks to evaluate the impact of video gaming on academic performance, involving variables such as internet access habits, video

game addiction, and alternative leisure time activities. This objective will be addressed through the Friedman Test, Chi-square test, comprehensive correlation analysis, and frequency tables.

Research Objectives

1. To Analyze the Relationship Between Internet Usage and Academic Performance
2. To Evaluate the Impact of Video Gaming on Academic Performance

2. Materials and Methods

In this study, data collection was conducted through a non-probability sampling method, specifically targeting postgraduate students enrolled in master's and Ph.D. programs. Participants were informed both verbally and in writing about the survey, ensuring transparency and ethical considerations in the data collection process. A total of 45 students actively participated by responding to an online questionnaire. This sample was stratified across two academic departments, with 22 students representing the Department of Chemistry and 23 students from the Department of Environmental Engineering. The participant group demonstrated a diverse range of nationalities, with the majority hailing from Taiwan, and others from Sri Lanka, India, Japan, Thailand, Vietnam, Swaziland, Iran, the USA, and Indonesia. The combined student population in both departments was approximately 190.

To facilitate data collection, an online questionnaire was developed using Google Forms, and participants were approached during the first academic semester of 2023. The questionnaire aimed to explore the relationship between internet usage, video gaming, and academic performance among postgraduate students. The structure of the paper followed three main sections: 1) Demographic features, detailing the background characteristics of the participants; 2) Internet usage and academic performance, exploring the impact of online activities on academic outcomes; and 3) Video game addiction and behaviors, delving into the relationships between gaming habits and academic performance. The collected data underwent rigorous analysis using the IBM SPSS 27 statistical software package. The analysis blueprint, detailed in Table 1, served as a guide in conceptualizing study concepts, identifying variables, and determining appropriate analytical tests. Association between variables was assessed using the Pearson chi-square test, with a significance level set at $p < 0.05$ and a confidence level at 95%.

Table 1. Strategic Analysis Blueprint: Examining Objectives, Variables, Expected Outcomes, and Employed Statistical Tests

	Objectives	Variables	Expected outcome	Test/method of data analysis
1	To analyze the relationship between internet usage and academic performance	<ul style="list-style-type: none"> • Internet usage hours • Playing videogames hours • Study hours • Sleeping hours • GPA 	<ul style="list-style-type: none"> • Find the association and model the relationship between academic performance and lifestyle practices. 	<ul style="list-style-type: none"> • Descriptive Analysis • Correlation analysis • Regression model • Friedman Test
2	To evaluate the impact of video gaming on academic performance	<ul style="list-style-type: none"> • Internet access through devices • Internet access habits on electronic devices across various activities • Potential negative impact of video gaming experiences • Alternative leisure time activities • Strategies to mitigate video game addiction • Videogame addiction • Academic performance 	<ul style="list-style-type: none"> • Identifying the dominant internet access habits across different activities. • Unveiling potential negative consequences associated with video gaming experiences. • Investigating the correlation between video game engagement and academic performance. • Assessing the efficacy of various strategies employed by students to mitigate video game addiction. • Examining alternative leisure time activities. 	<ul style="list-style-type: none"> • Freidman Test • Chi-square test • Comprehensive correlation analysis • Frequency tables

3. Results

3.1. Demographic Features

The demographic features of the sample are shown in Table 2 and were meticulously examined to provide a comprehensive understanding of the participants in this study. In terms of gender distribution, the sample comprised 23 male participants, accounting for 51.1% of the total, while 22 female participants constituted 48.9%. The gender distribution in the sample was nearly equal. The age distribution revealed that no participants were below the age of 22, representing 0% of the sample. A substantial portion fell within the age range of 22-27, with a frequency of 25 individuals, constituting 55.6% of the sample. Those aged 28 or above amounted to 20 individuals, making up 44.4% of the total participants. In examining the geographical representation, most participants hailed from Taiwan, with a frequency of 23, accounting for 51.1%. Other contributing countries included Sri Lanka (7) India (7), Thailand (2), the United States (1), Japan (1), Vietnam (1), Swaziland (1), Iran (1), and Indonesia (1). In this study, only postgraduate students were considered. Educational levels varied among the participants, with the majority holding a master's degree (68.9%), as opposed to a Ph.D. Degree, which was held by 31.1% of the sample. Finally, when considering the participants' academic backgrounds, 51.1% were pursuing a degree in Environmental Engineering, while 48.9% were pursuing Chemistry degree. These demographic details provide a nuanced perspective on the composition of the study participants, offering valuable context for the subsequent analyses and interpretations of the study's results.

3.2. Analyze the Relationship Between Internet Usage and Academic Performance

The analysis of key variables (Table 3) for postgraduate participants provides valuable insights into their academic performance, internet usage, video gaming habits, study hours, and sleeping patterns at a prestigious Taiwanese university. Participants exhibited diverse academic performance, with GPAs ranging from 1.78 (grade C) to 4.26 (grade A+), averaging at 3.70 (grade A-). Internet usage varied widely (1 to 10 hours), with a mean of 3.870 hours, showing significant diversity. Video gaming hours ranged from 0 to 6, averaging at 1.420 hours, with varying degrees of engagement. Study hours ranged from 2 to 10, with a mean of 5.71 hours, reflecting diverse study habits. Participants reported sleeping hours from 4 to 10, with a mean of 6.490 hours, indicating variability in sleeping patterns. These detailed statistics provide a nuanced understanding of factors influencing postgraduate students, forming the basis for subsequent analyses on correlations and associations, contributing to the broader academic community's understanding of the impact of internet usage and video gaming on academic performance.

Table 2. Sociodemographic characteristics of the sample

Variable		Frequency	Percentage %
Gender	Male	23	51.1
	Female	22	48.9
	Total	45	100
Age	Below 22	0	0
	22-27	25	55.6
	28 or above	20	44.4
Country	Taiwan	23	51.1
	Sri Lanka	7	15.6
	India	7	15.6
	Thailand	2	4.4
	United States	1	2.2
	Japan	1	2.2
	Vietnam	1	2.2
	Swaziland	1	2.2
	Iran	1	2.2
Indonesia	1	2.2	
Educational level	Master's degree	31	68.9
	Ph.D. degree	14	31.1
Degree	Engineering	23	51.1
	Science	22	48.9

Table 3. The descriptive analysis of key variables among the postgraduate participants

Variables	Minimum	Maximum	Mean	Std. Deviation
GPA	1.78	4.26	3.70	0.577
Internet usage hours	1	10	3.870	2.341
Videogames playing hours	0	6	1.420	1.699
Study hours	2	10	5.71	2.474
Sleeping hours	4	10	6.490	1.236

The correlation analysis explored relationships between GPA and lifestyle factors (internet usage, video game playing, study hours, and sleeping hours) for postgraduate participants. A modest positive correlation (0.230) between GPA and internet usage hours was observed, but it lacked statistical significance (Sig. value = 0.129), suggesting a potential random chance association. Conversely, there was a negligible negative correlation (-0.010) between GPA and video game playing hours, with a nonsignificant correlation (Sig. value = 0.947), indicating no discernible link between video gaming and academic performance. The positive but very small correlation (0.015) between GPA and study hours was nonsignificant (Sig. value = 0.923), suggesting study time had no significant impact on academic performance. Similarly, the small and positive correlation (0.014) between GPA and sleeping hours was nonsignificant (Sig. value = 0.930), indicating no statistically significant association between sleep duration and academic achievement. In summary, modest correlations were found between GPA and internet usage, study hours, and sleeping hours, but none reached statistical significance. Additionally, no significant correlation was identified between GPA and video game hours, providing nuanced insights into potential influences on academic performance among postgraduate students.

Table 4. Correlation between academic performance (GPA) and key variables of this study

	Internet usage hours		Playing videogames hours		Study hours		Sleeping hours	
	Cor.	Sig.	Cor.	Sig.	Cor.	Sig.	Cor.	Sig.
GPA	0.230	0.129	-0.010	0.947	0.015	0.923	0.014	0.930

The regression analysis conducted to explore the predictive utility of various lifestyle factors on the GPA of postgraduate students (Table 5) revealed insightful findings. The constant term in the model significantly contributed to the prediction of GPA, as indicated by the highly significant associated t-value of 5.697 (Sig. = 0.000), suggesting that when all predictor variables are zero, the expected GPA is 3.369 (grade A-). However, when examining individual predictor variables, study hours exhibited a non-significant positive relationship with GPA (B = 0.013, Beta = 0.055, Sig. = 0.732). Videogame hours displayed a non-significant negative relationship with GPA (B = -0.008, Beta = -0.023, Sig. = 0.889), indicating that videogame hours did not significantly impact GPA. Internet usage showed a non-significant positive relationship with GPA (B = 0.060, Beta = 0.242, Sig. = 0.130), and sleeping hours displayed a non-significant positive relationship with GPA (B = 0.005, Beta = 0.011, Sig. = 0.942). In summary, the regression model suggested that, within the scope of this study, the predictor variables of study hours, playing videogame hours, internet usage hours, and sleeping hours did not significantly contribute to the prediction of postgraduate students' GPA. These findings offer valuable insights into the nuanced relationships between lifestyle factors and academic performance among postgraduate students.

The Friedman test was conducted to investigate the diverse preferences among postgraduate participants regarding their daily use of electronic devices for internet access as illustrated in Tables 6 and 7. The first test examined device usage for distinct purposes: smartphones for social media, computers for academic tasks, and both devices for video game playing. Mean ranks indicated that smartphones ranked highest at 2.43 for social media engagement, closely followed by computers at 2.33 for academic purposes, while video game playing on either device received the lowest mean rank of 1.23, suggesting a lesser emphasis on this activity.

Table 5. The regression analysis to explore the predictive utility of various lifestyle factors on the GPA

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	3.369	0.591		5.697	0.000
Study hours	0.013	0.037	0.055	0.345	0.732
Playing videogames hours	-0.008	0.055	-0.023	-0.141	0.889
Internet usage hours	0.060	0.039	0.242	1.548	0.130
Sleeping hours	0.005	0.073	0.011	0.073	0.942

Table 6. The application of the Friedman test for ranking participants' internet access through devices

Internet access through devices	Mean Rank
1. Smartphones for social media access	2.43
2. Computers for academic purposes	2.33
3. Play videogames using smartphones or computers	1.23

In a subsequent test, participants were queried about their internet access habits on electronic devices across various activities. Mean ranks were determined for activities such as accessing social media for entertainment (mean rank = 4.49), utilizing devices for chatting with friends (mean rank = 4.28), engaging in educational activities (mean rank = 3.55), participating in online meetings via Zoom or Google Meet (mean rank = 3.55), playing video games online (mean rank = 2.92), and other purposes like accessing online shopping and online banking (mean rank = 2.22). These results shed light on the nuanced preferences and varied purposes for which postgraduate students employ electronic devices for internet access, enriching our understanding of their digital behaviors within an academic context.

3.3. To Evaluate the Impact of Playing Video Games on Academic Performance

The examination of the relationship between video game addiction and academic performance was undertaken using a Chi-square test, utilizing Taiwanese GPA grading standards within a prestigious university (Table 8). GPA categories ranged from A+ (4.00-4.30) to C- (1.30-1.69), with a B- (2.30-2.69) serving as the passing cutoff grade, aligning with a performance equivalent to 70%. Postgraduate students self-assessed their video game addiction levels as not addicted at all, slightly addicted, moderately addicted, very addicted, or extremely addicted. The Chi-square test, conducted on a sample of 45 postgraduate students, yielded a statistically significant result (Pearson Chi-Square = 38.085, df = 21, p = 0.013), indicating a meaningful association between video game addiction levels and academic performance. The distribution of grades across different levels of video game addiction revealed intriguing patterns. Students classified as "Not addicted at all" exhibited consistent representation across various grades (31 students). Conversely, those labeled "Slightly addicted" and "Moderately addicted" displayed more varied academic performances. The "Extremely addicted" group showed a distinctive grade distribution, including one student with a B grade. The Chi-square test serves as a robust statistical tool, providing insights into the nuanced relationship between video game addiction and academic success among postgraduate students in this esteemed university setting.

Table 7. The application of the Friedman test for ranking participants' internet access habits on electronic devices across various activities

Internet access habits on electronic devices across various activities	Mean Rank
1. Social media (YouTube, Facebook, Instagram, etc. for entertainment)	4.49
2. Chat with friends (WhatsApp, Line, Messenger)	4.28
3. Educational purposes (watch videos, download papers, read online articles, etc.)	3.55
4. Zoom/ Google Meetings	3.55
5. Play online videogames	2.92
6. Others (online Shopping, online banking, etc.)	2.22

The Friedman test was conducted to assess the potential negative impact of video gaming experiences on postgraduate students, who were asked to provide their reactions to multiple aspects. Participants could choose from various categories as illustrated in Table 9. The mean ranks obtained from the Friedman test for each category are as follows: notably, the category "None of the mentioned above" received the highest mean rank (5.11), neglecting friends or other interests and hobbies (4.93), being unable to stick to time limits on gaming (4.67), becoming anxious, angry, or irritable when unable to play games (4.40), changes in appetite or sleep patterns related to gaming (4.31), emotional outbursts if games are prohibited or limited (4.22), declining school performance or other responsibilities (4.31), and poor personal hygiene (4.04). These findings suggest that, on average, participants rated neglecting friends or other interests and hobbies as having the highest negative impact, while "None of the mentioned above" was perceived as having the least negative impact. These insights contribute to a nuanced understanding of the multifaceted experiences of postgraduate students in relation to video game habits, providing valuable information for academic discourse and potential interventions aimed at promoting student well-being.

Table 8. Application of the Chi-square test to identify the relationship between video game addiction and academic performance.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	38.085 ^a	21	0.013
Likelihood Ratio	31.467	21	0.066

N of Valid Cases 45

a. 29 cells (90.6%) have an expected count less than 5. The minimum expected count is .02.

In the first Friedman test, postgraduate students' strategies to mitigate video game addiction were explored (Table 10). Mean ranks revealed that asking friends and family for help (3.53) and trying other stress-relieving activities (3.53) were the most commonly employed strategies. Setting a strict time limit for daily play (2.77) and removing gaming devices from the bedroom (2.69) had slightly lower mean ranks, indicating somewhat lower adoption. Seeking gaming addiction treatment (meet doctor) had the lowest mean rank (2.48), suggesting less prevalence in employed strategies. These findings offer valuable insights into coping mechanisms used by postgraduate students to manage video game addiction, contributing to the discourse on digital well-being and mental health.

In the second Friedman test, alternative leisure time activities of postgraduate students were examined (Table 11). Engaging with family members and being with friends/partner emerged as the most favored activities, each with a mean rank of 4.87. Music/dancing/painting followed closely with a substantial mean rank of 4.63. Sports making fell into the moderately ranked category with a mean rank of 3.86, while other activities and pet animals secured a mean rank of 3.31. Gardening/handcraft making concluded the list with a mean rank of 3.16. These results provide a nuanced understanding of postgraduate students' diverse leisure choices, emphasizing familial and social interactions, artistic pursuits, and engagement with nature. Such insights contribute valuable information to the discourse on student well-being and lifestyle preferences in the academic environment.

The investigation into postgraduate students' dynamics encompassing gender, educational degree, video game addiction, and academic performance (GPA) was conducted through a comprehensive correlation analysis (Table 12). The examination of mean GPAs and their standard deviations across distinct subgroups revealed intriguing patterns within each category. Among Ph.D. students, a nuanced gender-based academic performance disparity emerged, with female students demonstrating a slightly higher mean GPA (4.0186, SD = 0.2122) compared to their male counterparts (3.8729, SD = 0.2244). Furthermore, the analysis unveiled intricate relationships between gender, video game addiction, and academic outcomes. Female students exhibited mean GPAs associated with varying levels of addiction, while among male students, those classified as extremely addicted surprisingly displayed a higher mean GPA compared to other addiction categories. These findings contribute valuable insights into the complex interplay of gender, educational degree, video game addiction, and academic performance among postgraduate students, prompting further exploration into the unexpected correlations observed.

Table 9. The application of the Friedman test assesses the potential negative impact of video gaming experiences on postgraduate students.

Potential negative impact of video gaming experiences	Mean Rank
1. Not any of the mentioned	5.11
2. Neglecting friends or other interests and hobbies	4.93
3. Being unable to stick to time limits on gaming	4.67
4. Changes in appetite or sleep patterns related to gaming	4.40
5. Becoming anxious, angry, or irritable when unable to play games	4.31
6. Declining school performance or other responsibilities	4.31
7. Emotional outbursts if games are prohibited or limited	4.22
8. Poor personal hygiene	4.04

Table 10. The application of the Friedman test to identify the strategies employed by postgraduate students to mitigate video game addiction in their lives.

Strategies to mitigate video game addiction	Mean Rank
1. Try other stress-relieving activities	3.53
2. Set a strict time limit for daily play	3.53
3. Remove gaming devices from the bedroom	2.77
4. Ask friends and family for help	2.69
5. Seek gaming addiction treatment (meet doctor)	2.48

These findings provide nuanced insights into the multifaceted relationships between gender, educational degree, video game addiction, and academic performance among postgraduate students. The exploration of these dynamics contributes valuable knowledge to the ongoing discourse on student well-being and sheds light on the intricate balance between digital leisure activities

and academic success.

The findings of our study unveil intriguing insights into the correlation between age and video game addiction, providing a glimpse into the diverse patterns of gaming behavior among participants in distinct age brackets. Within the 22 to 27 age range, a considerable diversity in gaming habits is evident, with six participants reporting complete abstinence from playing video games. Conversely, among those who engage in gaming, there is a varied distribution in the duration of play, ranging from less than 1 hour to 6 hours or more. Transitioning to the 28 or above age range, 12 participants abstained from gaming, while others reported playing for varying durations, primarily less than 1 hour. Participants in the 22-27 age range exhibit a broader spectrum of gaming habits, with a notable proportion engaging in more extended gaming sessions. Conversely, participants aged 28 or above tend to play video games less frequently, indicated by a higher number reporting no gaming activity or engaging in shorter gaming sessions. This discrepancy in gaming behavior across age groups suggests a potential association between age and video game preferences, showcasing a nuanced interplay between age demographics and gaming habits among the study participants.

Table 11. The application of the Friedman test discerns the alternative leisure time activities

Alternative leisure time activities	Mean Rank
1. Be with friends/ partner (chat, trip, etc.)	4.87
2. Be with family members (chat, trip, cooking, etc.)	4.87
3. Music/ dancing/ painting	4.63
4. Sports	3.86
5. Pet animals (dog, cat, etc.)	3.31
6. Others	3.31
7. Gardening, hand craft making	3.16

Among females, a significant portion, 9 individuals, did not engage in video game playing. Of the remaining participants, 8 reported playing for less than 1 hour per day, 1 played for 3 hours, 2 played for 4 hours, and 2 played for 5 hours per day. No female participants reported playing more than 6 hours per day. On the male side, 9 individuals did not play, 5 played for less than 1 hour, 2 played for 2 hours, 5 played for 3 hours, 1 played for 5 hours, and 1 played for 6 hours or more per day. This distribution provides a detailed overview of video game engagement patterns within each gender group, highlighting variations in playing habits. The data suggests that a higher proportion of males exhibit a preference for spending more time on video games compared to females. Specifically, a greater number of males reported engaging in video game playing for various durations, including instances of playing for 2, 3, 5, and 6 hours or more per day. In contrast, a notable portion of females, represented by 9 individuals, did not participate in video game playing at all. Among the remaining female participants, the majority reported playing for less than 1 hour per day, indicating a potential discrepancy in video game preferences and engagement between the genders.

Table 12. Comprehensive correlation analysis

Gender	Educational level		GPA	
			Mean	Standard Deviation
Female	Education	Master's degree student	3.7607	0.2763
		Ph.D. degree student	4.0186	0.2122
Male	Education	Master's degree student	3.4201	0.8489
		Ph.D. degree student	3.8729	0.2244

Gender	Addiction level
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Female	<i>Addiction</i>	Moderately addicted	3.8500	
		Not addicted at all	3.8619	0.2882
		Slightly addicted	3.7800	0.3102
Male	<i>Addiction</i>	Extremely addicted	4.0100	
		Moderately addicted	3.8200	0.2857
		Not addicted at all	3.4028	0.8687
		Slightly addicted	3.8333	0.3402

Table 13 provides a comprehensive breakdown of academic grades corresponding to different levels of video game addiction among the study participants. The grades, categorized from A to C+, are cross-tabulated with addiction levels—extremely addicted, moderately addicted, slightly addicted, and not addicted at all. Among the extremely addicted, a singular representation is observed in the B grade category. The moderately addicted group shows occurrences in A-, B, and C+, totaling 5 individuals. The not addicted at all category, the largest representation, encompasses diverse grades (A, A-, A+, B, B+, C-, and C+), with 31 individuals. The slightly addicted group exhibits grades A-, A+, and B, totaling 8 individuals. This cumulative view underscores diverse academic performances among participants with varying addiction levels. The not addicted at all group shows a broad distribution, while the moderately and slightly addicted categories display specific grade patterns. This breakdown contributes to a comprehensive understanding of the interplay between video game addiction and academic achievement among postgraduate students.

Table 13. Comprehensive breakdown of academic grades corresponding to different levels of video game addiction

	Grades									Total
	A	A-	A+	B	B+	B-	C	C-	C+	
Extremely addicted	0	0	0	1	0	0	0	0	0	1
Moderately addicted	2	1	0	2	0	0	0	0	0	5
Not addicted at all	9	5	10	0	2	0	1	1	3	31
Slightly addicted	0	5	3	0	0	0	0	0	0	8
Total	11	11	13	3	2	0	1	1	3	45

The research inquiry delved into postgraduate students' perspectives on the complex relationship between video game engagement, academic performance, and the availability of support systems to manage potential addiction. Participant responses revealed a diverse range of experiences within this specific student cohort. In evaluating the impact of video games on academic performance, two respondents acknowledged a positive influence, nine expressed a generally positive impact, 13 reported a moderate effect, six indicated a low negative impact, and 12 identified a high negative impact. This spectrum underscores the multifaceted nature of the interplay between video game engagement and academic outcomes. Regarding academic responsibilities, 12 participants admitted to skipping or neglecting tasks due to video game playing, shedding light on potential challenges to academic commitment. Exploring the presence of support systems, 24 participants affirmed supportive structures, while 19 reported a lack thereof, highlighting varying accessibility and utilization of support networks in addressing video game addiction concerns. In qualitative insights, participants shared personal experiences, including physical symptoms like severe headaches and observations of fatigue and reduced concentration after late-night gaming. Positive aspects, such as making friends through online gaming, were noted, alongside cautionary notes emphasizing the avoidance of stimulating games for better sleep and concerns about changes in personality, including heightened aggression. In conclusion, the diverse responses contribute nuanced perspectives on the intricate dynamics between video game engagement, academic performance, and the presence or absence of support systems among postgraduate students.

4. Discussion

The investigation into the impact of technology use on the academic performance of individuals has long been a topic of discussion, particularly in the context of children, adolescents, and young adults. Much of the existing research has primarily focused on elementary, junior, or senior high school students, as well as undergraduate students, often in their teenage or early adolescent years. However, there remains a limited number of studies targeting postgraduate students, a demographic encompassing both master's and Ph.D. candidates. This study addresses this gap by specifically targeting postgraduate students, particularly those in the early adult stage, and includes individuals from the departments of chemistry and environmental engineering. These postgraduate students are engaged in a multifaceted academic environment, involving not only classroom lectures but also extensive laboratory experimental work. Their responsibilities extend beyond coursework to encompass paper writing, conference participation, examinations, and regular progress meetings with supervisors. With such a demanding schedule, understanding their engagement with internet usage, especially video game addiction, becomes crucial. This research aimed to delve into the internet usage patterns of postgraduate students, focusing on video game addiction levels and exploring how these activities impact their academic performances. The study also examined their sleeping patterns, leisure time activities, and the allocation of time between video gaming and other internet activities for entertainment, shedding light on the intricate relationship between these factors and academic success. Additionally, the research investigated the behavioral and emotional changes resulting from internet and video game engagement, as well as the strategies employed by students to manage their time and energy effectively in the midst of their demanding academic lives.

The gender distribution within the sample was well-balanced, and participants represented diverse geographical backgrounds, hailing from Taiwan (majority), Sri Lanka, India, Thailand, the United States, Japan, Vietnam, Swaziland, Iran, and Indonesia. Educational levels varied, with a majority holding master's degrees and the remaining possessing Ph.D. degrees. The first objective aimed to analyze the relationship between internet usage and academic performance, revealing descriptive statistics that shed light on key variables. The mean internet usage was 3.870 hours, showcasing significant diversity, and video game playing exhibited a mean of 1.420 hours, indicating varying degrees of engagement. Study hours averaged 5.71 hours, and participants reported diverse sleeping patterns with a mean of 6.490 hours. Correlation analysis explored the relationships between GPA and lifestyle factors. Modest correlations were observed with internet usage hours, study hours, and sleeping hours, while video game hours showed no significant correlation. Regression analysis delved into the predictive utility of lifestyle factors on GPA, revealing that study hours, video game hours, internet usage hours, and sleeping hours did not significantly contribute to GPA prediction. The Friedman test investigated preferences in daily electronic device use for internet access. Mean ranks indicated smartphones were predominantly used for social media access, computers for academic purposes, and video game playing ranked lowest. These findings collectively provide nuanced insights into the intricate relationships between lifestyle factors and academic performance among postgraduate students.

In addressing the second objective of this study, we delved into the evaluation of the impact of playing video games on academic performance among postgraduate students in a prestigious Taiwanese university. Utilizing a Chi-square test and employing Taiwanese GPA grading standards, findings revealed a meaningful association between video game addiction levels and academic performance. The distribution of grades across different addiction categories presented intriguing patterns. The majority of students classified as "Not addicted at all" displayed a consistent representation across various grades, totaling 31 students. This outcome aligns with expectations, considering their busy schedules, indicating a lack of significant time spent on video games. Conversely, the group labeled as "Extremely addicted" exhibited a distinctive distribution of grades, including one student with a B grade, suggesting a potential correlation between video game addiction and academic performance. Additionally, Friedman tests were conducted to investigate potential negative impacts of video gaming experiences, strategies employed to mitigate video game addiction, and alternative leisure time activities chosen by postgraduate students. These tests provided nuanced insights into the multifaceted experiences of postgraduate students in relation to video game habits, coping mechanisms, and recreational choices. The diverse leisure activities chosen by postgraduate students during their non-academic hours, including familial and social interactions, artistic pursuits, and engagement with nature, contribute to the ongoing discourse on student well-being and lifestyle preferences in the academic environment. Furthermore, our exploration of the complex interplay of gender, educational degree, video game addiction, and academic performance through comprehensive correlation analysis revealed distinctive mean GPAs for female and male students at varying academic levels. Notably, female Ph.D. students exhibited a slightly higher mean GPA than their male counterparts, reflecting a nuanced gender-based academic performance disparity. The analysis of gender and video game addiction unveiled intriguing relationships between gaming habits and academic outcomes, challenging preconceptions. These findings contribute valuable knowledge to the discourse on student well-being and highlight the intricate balance between digital leisure activities and academic success. Moreover, this investigation into the correlation between age and video game addiction revealed varying patterns of gaming behavior among participants in different age brackets. Participants aged 22-27 exhibited a broader spectrum of gaming habits, with a notable proportion engaging in more extended gaming sessions. In contrast, participants aged 28 or above tended to play video games less frequently. This discrepancy in gaming behavior across age groups hints at a possible association between age and video game preferences, reflecting a nuanced interplay between age demographics and gaming habits among the study participants.

When consider the previous studies, Núñez-Pacheco (2023) discovered that the utilization of video games is more prevalent among male students (95%) compared to their female counterparts (73.4%) studying at college of engineering (Núñez-Pacheco et al., 2023). The research revealed that these students exhibit a preference for strategy video games, primarily engaging in them for purposes of escape, entertainment, and socioemotional activation. The study concludes that there is a correlation between consumption habits and motivations, as heightened video game consumption correlates with increased motivation among young individuals to play them (Núñez-Pacheco et al., 2023). Video game use is more prevalent among younger individuals, suggesting a decline in in-

terest with advancing age (Garcés et al., 2015; Núñez-Pacheco et al., 2023). A study involving school students found that approximately 70% spent over 2 hours daily on the internet, and nearly 30% engaged in electronic games for the same duration. Intensive weekday internet use (over 4 hours) was linked to lower scores in reading and numeracy, while weekend internet use (2-4 hours) correlated positively with academic performance. Surprisingly, 16% of electronic gamers showed a higher likelihood of achieving better reading scores on weekdays. This study highlights an adverse association between internet and electronic gaming addiction tendencies and academic achievement among students (Islam et al., 2020). A separate study revealed that students with high academic achievement spend a considerable amount of time playing video games, with a statistically significant correlation ($p = .005$). Intriguingly, these students invest nearly as much time in gaming as they do in academic pursuits, yet manage to maintain high academic grades (Adžić et al., 2021). In a 2021 study by Roslan et al., no significant association was identified between online game addiction and academic performance (p -value = 0.850). The absence of correlation suggests that other factors, such as intelligence levels and study time, could be influential contributors to academic outcomes (Roslan et al., 2021). Over the past decade, studies have highlighted the advantages of smartphones, which have become indispensable, particularly for young adults. A study conducted by Abbasi et al., (2021) investigated the relationship between smartphone usage patterns, addiction, and academic performance. It proposed physical activity as a preventive measure to counteract the impact of content-based smartphone use on addiction. Results indicated that entertainment, social networking, and gaming usage positively correlated with smartphone addiction. While study-related usage positively affected academic performance, game-related use and smartphone addiction exhibited negative effects (Ghazanfar A Abbasi et al., 2021).

In summary, current study provides a comprehensive examination of the impact of internet usage and video gaming on the academic performance of postgraduate students in a prestigious Taiwanese university. The nuanced insights gleaned from these analyses contribute to the broader academic discourse on student well-being, digital habits, and the delicate balance between leisure activities and academic success in a demanding academic environment.

Conclusion

In conclusion, our study aimed to unravel the intricate relationship between internet usage, videogaming, and the academic performance of postgraduate students at a prestigious Taiwanese university. Our research objectives guided the analysis blueprint, encompassing a diverse sample of master's and Ph.D. students. Descriptive statistics provided a nuanced understanding of academic and lifestyle factors, revealing varied internet and gaming engagement patterns. Correlation analyses indicated modest relationships between GPA and lifestyle factors, though statistical significance was not reached. The regression model showed that study hours, gaming hours, internet usage, and sleeping hours did not significantly predict GPA. The Chi-square test highlighted a meaningful association between video game addiction and academic performance, emphasizing the need for further exploration. Friedman tests explored negative impacts, coping mechanisms, and alternative leisure activities, offering valuable insights into students' experiences. Notably, female Ph.D. students exhibited a slightly higher GPA, and age-related variations in gaming habits were observed. Our findings contribute to the discourse on digital well-being, shedding light on the multifaceted recreational landscape and academic challenges faced by postgraduate students. Addressing these concerns is crucial for fostering balanced lifestyles and promoting holistic well-being in the evolving digital landscape of postgraduate education.

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