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Does Internet Gaming Disorder Hinder Academic Performance?

(Apakah Internet Gaming Disorder Menghambat Kinerja Akademik?)

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Abstract: In 2018, the WHO has categorized gaming disorder as an official disease. One of the ways to estimate a person's gaming disorder level or status is to use the IGD-20 Test. The purpose of our research is to determine whether or not internet gaming disorder (IGD) has a significant negative impact on academic performance using binary dependent and two-staged least squares models. We obtained data from 390 Indonesian university students, consisting of their academic performance, IGD level, gaming behavior, and several of their economic and demographic characteristics. We found that 5.13 percent of the respondents have IGD. Using both probit and logit models, we also found that GPA has no significant impact on a person's probability to have IGD. Finally, using a 2SLS model, we discovered that IGD has no considerable effect on GPA. Instead, income and gender are proven to be significant predictors of GPA.

Keywords: gaming disorder; IGD; academic performance; Indonesia; instrument

Abstrak: Pada tahun 2018, Organisasi Kesehatan Dunia mengategorikan *gaming disorder* sebagai sebuah penyakit. Salah satu cara menentukan status atau tingkat gangguan ini ialah menggunakan tes IGD-20. Tujuan dari penelitian ini ialah menentukan apakah *IGD* memiliki dampak signifikan terhadap kinerja akademik. Penulis memperoleh data primer dari 390 partisipan mahasiswa terkait hasil studi atau kinerja akademik, tingkat *IGD*, perilaku bermain *game*, dan beberapa karakteristik demografik dan ekonomik. Penulis menemukan 5,13 persen partisipan menderita *IGD*. Berdasarkan hasil analisis data menggunakan model probit dan logit, penulis menemukan indeks prestasi kumulatif tidak memiliki pengaruh signifikan terhadap kemungkinan memiliki *IGD*. Sedangkan pengujian menggunakan model *two-stage least squares* juga menunjukkan bahwa *IGD* tidak berpengaruh signifikan terhadap indeks prestasi kumulatif. Variabel yang ditemukan sebagai determinan indeks prestasi ialah tingkat penghasilan dan gender.

Kata kunci: kecanduan *game*; *IGD*; performa akademik; Indonesia; instrumen

INTRODUCTION

Video games have become a mainstream form of entertainment, not only for kids but also for adults. As the world population grows, the number of gamers worldwide also increases (Gough, 2019). However, video games tend to be considered a negative hobby, as video games' attitude can be different across cultures and countries. One example would be the banning of PlayerUnknown's Battlegrounds (PUBG), a "battle royal" shooter game in Indonesia and Malaysia (Jakarta Globe, 2019).

More importantly, in 2018, the World Health Organization (WHO) has officially included "Gaming Disorder" as a disease. According to the World Health Organization (2018), gaming disorder is characterized by the lack of control caused by excessive gaming, to a point where a person's gaming activity disrupts their other activities. The inclusion of "gaming disorder" in the 11th International Classification of Diseases (ICD -11) has sparked controversies among academics and health professionals. In particular, Van Den Brink (2017) argued that with no consensus on the definition of gaming disorder, gaming may end up being demonized and can result in many false-positive treatments. On the contrary, Király and Demetrovics (2017) argued that although there are some concerns regarding the division between offline and online gaming disorders, gaming disorder has more advantages than disadvantages.

Thus, this research aims to observe one of the assumed negative impacts of video games, in this case, their impact on university students' academic performances. For this research, econometrics approaches, such as dependent binary models and two-staged least squares models, were used to investigate whether or not gaming disorder, or specifically, internet gaming disorder, has a significant negative impact on academic performance.

One of the most popular ways to determine whether someone has a gaming disorder or not is by using the IGD-20 Test, developed by Pontes et al. (2014). Internet Gaming Disorder (IGD), which is included in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) by the American Psychiatric Association (APA), is associated with a person who participates in any gaming activity, especially online games, to a point where they would ignore any other interests (American Psychiatric Association, 2013). In fact, a person with IGD could endanger their academic and job performance by playing games too much. They will experience withdrawal symptoms such as distress when they have not been gaming for a certain period.

The gaming disorder acknowledged by WHO shared many similarities with the IGD that is tested in IGD-20. Despite the term "internet" in its name, IGD does not only concern itself with online games but all gaming related activities such as playing on a PC, gaming console, or mobile games, as well as online or offline games. This confusion in name and definition causes a controversy, which has been voiced by Kuss et al. (2017), who argued that there needs to be a clearer definition of IGD, as well as properly distinguishing a person with internet addiction and IGD.

Study on the impact of gaming disorder becomes essential because research shows how IGD can harm a person's academic performance and psychological well-being. Van Den Brink (2017) argued that gaming is just a harmless recreational activity for the most part, with only a small portion of gamers losing self-control through the activity. Simultanously, Stavropoulos et al. (2019) have been able to prove a significant relationship between being diagnosed with IGD and being a "Hikikomori," which is a Japanese term for a person who suffers from extreme real-life social withdrawal. Thus, Sampogna et al. (2018) argued that while IGD can create a common ground for research and treatments, more studies are needed to understand the trajectory of IGD.

In addition, the impact of gaming on academic performance has been researched by several researchers. However, more researches are needed because without enough conclusive evidence gained from different methods, a false conclusion could be drawn, leading to false negative treatments. Using Analysis of Variance (ANOVA), Wright (2011) found that the mean grade point average (GPA) of non-gamers are significantly higher than gamers. In contrast, despite the negative stigma on gaming by parents, Dumrique and Castillo (2018) found no correlation between online gaming activity and academic performance. While both correlation and ANOVA are integral statistical techniques, there are many other ways to analyze the impact of gaming on academic performance. Correlation is not causation, and thus we want to observe the ceteris paribus impact of excessive gaming on academic performance.

Furthermore, using a more legitimate test such as the IGD-20 test would build more legitimacy to our research and perhaps shine a brighter light on IGD, factors that affect IGD, and its impact on academic performance.

The relationship between IGD and academic performance has been researched by Hawi et al. (2018), who used hierarchical multiple regression analysis and found academic performance has a significant negative impact on IGD-20 score. On the other hand, we used probit and logit models to estimate whether academic performance has a significant negative impact on the probability of having IGD (a score of 71 or higher). Furthermore, we have also investigated the impact of IGD on academic performance. Our results may show that IGD hinders academic performance.

Some researchers have found the factors that can affect a person's gaming disorder score/status and academic performance. For gaming disorder, many have considered psychological variables to be predictors of IGD. For example, Scerri et al. (2019) found a significant relationship between need-fulfillment deficits and IGD behavior. Furthermore, Cheng et al. (2018) found a substantial connection between IGD symptoms and psychological problems, especially in countries with lower power. However, Wichstrøm et al. (2019) found that for youths, symptoms of IGD are only marginally associated with symptoms of other psychological disorders. Interestingly, Triberti et al. (2018) found that what matters is not how much time is spent playing video games but at what time they are playing video games. They found that those who play on weekend mornings are more likely to exhibit IGD.

As for academic performance, one of the most interesting variables that could impact academic performance is gender. Paver and Gammie (2005) found that gender has no significant impact on academic performance. However, Icekson et al. (2019) concluded that optimistic expectations affect men and women's academic performance very differently. They found that optimistic expectations increase women's academic performance with high conscientiousness and reduce the academic performance of men with low conscientiousness. Another interesting variable that could reasonably affect academic performance is academic entitlement. However, Reysen (2013) found no significant relationship between educational entitlement and academic performance. Similarly, Mallett (2009) found that global self-esteem has no significant impact on academic performance. Lu et al. (2017) also found that perceived maternal psychology control has no effect on academic performance.

This research's potential contribution for the guidance and counseling academic discipline is that the results of this research may share more light on how counselors should approach students who play video games excessively and are having trouble with their studies. In particular, this research may show factors that affect a student's gaming and studying habits and help counselors find the root of the problem.

METHOD

The IGD-20 Test is a useful, valid, and reliable tool made by Pontes et al. (2014) to measure a person's internet gaming disorder score. The cut-off point of 71 is used to separate those who have an internet gaming disorder, and those who do not. Thus, anyone with a score of 71 or higher is considered to suffer from internet gaming disorder.

Respondents were asked to respond to the following 20 statements presented in Table 1, with either "strongly disagree," "disagree," "neither agree nor disagree," "agree," and "strongly agree." Each statement was equipped with 1 to 5 scales, with score 1 represented strong disagreement, while point 5 showed strong agreement, except for questions 2 and 19, where the points were reversed.

The research method used in this research is regression analyses, specifically Ordinary Least Squares, Probit, Logit, and Two-Staged Least Squared regression analyses. One way to estimate the relationship between academic performance, gaming disorder, and other economic and demographic factors is by using Ordinary Least Squares (OLS) as presented at Equation (1).

$$academicperformance_i = \beta_0 + \beta_1 gamingdisorder_i + X\beta + u_i \qquad (1)$$

In Equation (1), $academicperformance_i$ represents the grade point average of respondent i, used as a proxy of academic performance $gamingdisorder_i$ represents the gaming disorder score or status of respondent i, X represents other observed gaming, economic and demographic factors that can affect

Table 1. Statements in IGD-20

No	Statement
1	I often lose sleep because of long gaming sessions.
2	I never play games to feel better.
3	I have a significantly increased amount of time playing games over last year.
4	When I am not gaming, I feel more irritable.
5	I have lost interest in other hobbies because of my gaming.
6	I would like to cut down my gaming time, but it isn't easy to do.
7	I usually think about my next gaming session when I am not playing.
8	I play games to help me cope with any bad feelings I might have.
9	I need to spend increasing amounts of time engaged in playing games.
10	I feel sad if I am not able to play games.
11	I have lied to my family members because of the amount of gaming time I spent.
12	I do not think I can stop gaming.
13	I think gaming has become the most time-consuming activity in my life.
14	I play games to forget about things that bother me.
15	I often think that a whole day is not enough to do everything I need to do in-game.
16	I tend to get anxious if I cannot play games for any reason.
17	I think gaming has jeopardized my relationship with my partner.
18	I often try to play games less, but I always fail.
19	I know my main daily activity (i.e., occupation, education, homemaker, so forth.) has not been negatively affected by my gaming.
20	I believe my gaming is negatively impacting essential areas in my life.

the dependent variable; and u_i represents any unobserved factors that can affect the dependent variable. If the estimated value of β_1 in Equation (1) is negative and statistically significant, then gaming disorder had a significant negative impact on academic performance. In contrast, if the estimated parameter of β_1 in Equation (1) is not significant or significantly positive, then there is no proof to conclude a negative relationship between gaming disorder and academic performance.

However, there were reasons to argue that the estimated parameter of β_1 in Equation (1) might be biased. First, there might be other unobserved factors in the error term of Equation (1) correlated with a person's gaming disorder score. Thus, we included variables that significantly correlated with gaming disorder scores and significantly impacted academic performance. Second, academic performance and gaming disorder score could be simultaneously determined. Gaming disorder score could significantly impact academic performance and vice versa. Thus, before we jump to other methods, it could be beneficial to consider Equation (2).

$$gamingdisorder_i = \beta_0 + \beta_1 academicperformance_i + X\beta + u_i \tag{2}$$

In Equation (2), $gamingdisorder_i$ must be measured as a score. If it was measured as a status, then we would need to use a different method, such as the probit or logit methods. When we measured gaming disorder as a binary variable (the respondent suffers from gaming disorder or not), we could not use OLS since it exhibited heteroskedasticity and could give an estimate that is higher than 1 or lower than 0, which do not make sense for a binary variable. Thus, we also used Equation (3) and (4). In equation (3), Λ represents a logistic distribution and Φ in Equation (4) represents a normal distribution. Note that $gamingdisorder_i$ must be a binary variable in Equation (3) and (4).

$$gamingdisorder_i = \Lambda(\beta_0 + \beta_1 academicperformance_i + X\beta + u_i) \tag{3}$$

$$gamingdisorder_i = \Phi(\beta_0 + \beta_1 academicperformance_i + X\beta + u_i) \tag{4}$$

We could also use a two-stage least squares method to estimate the relationship between gaming disorder and academic performance as long as we have the appropriate instrument variables as presented in Equation (5) and (6).

$$academicperformance_i = \beta_0 + \beta_1 \widehat{gamingdisorder}_i + X\boldsymbol{\beta} + u_i \tag{5}$$

$$gamingdisorder_i = \gamma_0 + Z\boldsymbol{\Gamma} + v_i \tag{6}$$

A good instrument variable is a variable that is correlated with the endogenous regressor and uncorrelated with the dependent variable. In this case, we were looking for variables that could affect a person's gaming disorder score but did not directly affect academic performance. Note that the instrument variables of the exogenous variables were the variables themselves.

All data used in this research were primary data obtained using surveys. We were able to gather data from 400 undergraduate students (19 to 25 years old) from several Indonesian universities and faculties, but we ended up with 390 samples (223 female, 167 male) as ten out of those 400 entries were considered invalid or duplicates. Respondents were asked for their email address, full name, gender, occupation, faculty, birthdate, marital status, current GPA (0 to 4 index), monthly income (measured in Rupiahs), monthly expenses (measured in Rupiahs), father's education, mother's education, average daily gaming time (measured in hours), preferences in gaming genres. Additionally, they were also asked whether they own certain gaming consoles or not, whether they like to play "free-to-play" (F2P) games, whether they have spent money on F2P games, how much money they have spent for F2P games (measured in Rupiahs), whether they watch "Let's Play" (LP) videos, how watching LP videos affect their gaming buying intentions, what kind of games they like to watch, reasons for watching LP videos, who asked them to fill the surveys (for checking purposes) and most importantly, the IGD questions based on the instrument developed by Pontes et al. (2014). As Pontel et al., the IGD questions were translated to Bahasa Indonesia (the respondents' first language) so that the respondents would be able to understand the questions fully.

RESULTS

Table 2 shows the Pearson correlation between each IGD item and its totals, with their respective p-values in round brackets. Note that for items IGD2 and IGD19, the points were reversed. In Table 2, *** is significant at 1%. In Table 2, we can see that all IGD items significantly correlate with the IGD total value at 1% level of significance. Thus, we can conclude that all of the IGD items we used are valid.

Based on our 20 IGD items and 390 respondents, we tested its reliability and found the Cronbach's Alpha value of 0.898. Since the Cronbach's Alpha value is high, we can conclude that the IGD data we obtained are reliable. Table 3 shows the descriptive statistics of several variables obtained from the surveys. Table 3 shows that the average values of the variables are reasonable. The minimum and maximum values of each variable also show that we have deleted any outliers.

Table 4 shows the relative frequency of the categories in each variable. We can see that 91.54% of the respondents are full-time students. Most students earn 1-2 million rupiahs per month (including allowance from parents or guardians), and they also spend 1-2 million rupiahs per month on average. We also found that most of the respondents' parents have at least a bachelor's degree. As for their gaming behaviors, most of the respondents (24.62%) spend 1-2 hours on video games on a daily basis. Finally, if we use the score of 71 as the cut-off value of IGD (higher than 70 means the person is diagnosed with IGD), we found that only 5.13% of our respondents have IGD.

On Figure 1, we can see a weak negative linear relationship between IGD total score and GPA. Note that the Pearson correlation value between IGD score and GPA is -0.1465, with a p-value of 0.0037. This shows that there is a significant negative correlation between IGD score and GPA.

Table 2. Pearson Correlation of IGD Items and the IGD Total Score

IGD Item	Correlation with IGD Total	IGD Item	Correlation with IGD Total
IGD1	0.641 (0.000)***	IGD11	0.674 (0.000)***
IGD2R	0.193 (0.000)***	IGD12	0.703 (0.000)***
IGD3	0.624 (0.000)***	IGD13	0.592 (0.000)***
IGD4	0.679 (0.000)***	IGD14	0.627 (0.000)***
IGD5	0.727 (0.000)***	IGD15	0.690 (0.000)***
IGD6	0.692 (0.000)***	IGD16	0.788 (0.000)***
IGD7	0.757 (0.000)***	IGD17	0.510 (0.000)***
IGD8	0.669 (0.000)***	IGD18	0.748 (0.000)***
IGD9	0.700 (0.000)***	IGD19R	0.177 (0.000)***
IGD10	0.727 (0.000)***	IGD20	0.290 (0.000)***

Table 3. Descriptive Statistics of GPA, IGD Total Score, Age, Income and Expense

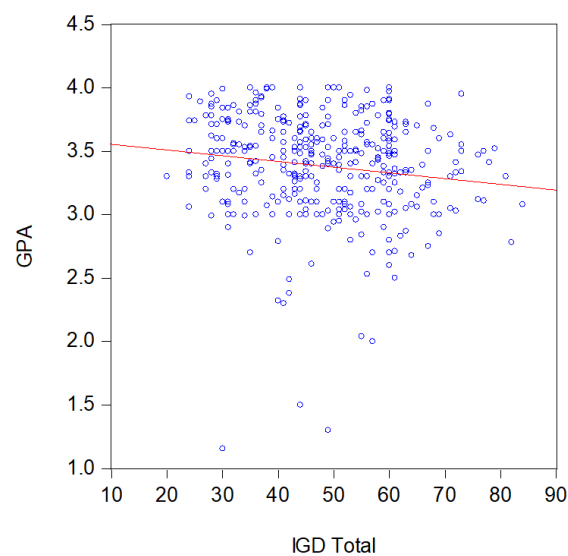|	GPA	IGD Total	Age	Income	Expense
Mean	3.382115	48.32051	19.17179	2665385	1852564
Median	3.415000	48.50000	19.00000	1500000	1500000
Maximum	4.000000	84.00000	25.00000	20000000	20000000
Minimum	1.156000	20.00000	16.00000	500000	500000
Std. Dev.	0.400645	13.01561	1.074942	2850645	2000175
Observations	390	390	390	390	390

Figure 1. Scatter Plot - IGD vs. GPA

Table 4. Relative Frequency of Variables with Mutually Exclusive Categories

Variable	Category	Relative Percentage	Variable	Category	Relative Percentage
Gender	Male	42.05%	Gaming Time	Do not play video games	22.56%
	Female	57.18%	(daily average)	Less than 1 hour	19.74%
	Other	0.77%		1 to 2 hours	24.62%
	Total	100.00%		2 to 5 hours	22.82%
Employment	Full-Time Student	91.54%		5 to 10 hours	8.46%
Status	Working Full-Time	3.33%		More than 10 hours	1.79%
	Working Part-Time	1.79%		Total	100.00%
	Freelancer	2.31%	IGD Status	IGD	5.13%
	Other	1.03%		No IGD	94.87%
	Total	100.00%		Total	100.00%
Faculty	Agriculture	1.28%	Marital Status	Single	99.74%
	Animal Science	0.26%		Married	0.26%
	Bioengineering and Food Technology	2.56%		Total	100%
			Income	Less than 1 million rupiahs	21.28%
	Business	32.56%	(monthly	1 to 2 million rupiahs	38.21%
	Cultural Studies	2.31%	average)	2 to 5 million rupiahs	31.28%
	Design and Multimedia	2.56%		5 to 10 million rupiahs	7.44%
				10 to 20 million rupiahs	0.51%
	Economics	1.28%		More than 20 million rupiahs	1.28%
	Education	1.54%			
	Engineering	15.90%		Total	100.00%
	Hospitality and Tourism	3.33%	Expense (monthly	Less than 1 million rupiahs	36.41%
	Language	1.28%	average)	1 to 2 million rupiahs	38.97%
	Law	2.56%		2 to 5 million rupiahs	20.77%
	Mathematics and Natural Science	3.59%		5 to 10 million rupiahs	3.08%
				10 to 20 million rupiahs	0.51%
	Medicine, Nursery Education and Public Health	3.85%		More than 20 million rupiahs	0.26%
				Total	100.00%
	Pharmacy	1.79%	Father Highest	No education or lower than high school	6.15%
	Psychology	5.64%	Education		
	Secretarial Studies	0.51%		High School	35.64%
	Social Science and Political Science	13.08%		Diploma	11.79%
				Bachelor	37.69%
	Other	0.77%		Master	6.41%
	No Tertiary Education	3.33%		Doctorate	2.31%
				Total	100.00%
	Total	100.00%	Mother Highest	No education or lower than high school	5.64%
			Education		
				High School	37.44%
				Diploma	18.72%
				Bachelor	35.38%
				Master	2.56%
				Doctorate	0.26%
				Total	100.00%

Factors of Internet Gaming Disorder

At Equation (7), (8), and (9), igd_total_i a represents the total IGD score for respondent i (measured as an index from 20 to 100), igd_i is a dummy variable that takes a value of 1 if respondent i has IGD (IGD score $\geq$ 71) and 0 otherwise, Λ represents a logistic distribution, Φ is a normal distribution, gpa_i represents the current grade point of respondent i (measured as an index from 0 to 4), $game\_console_i$ represents the number of gaming console owned by respondent i, $game\_variety_i$ represents the number of gaming genre liked by respondent i, $game\_time_i$ represents the respondents' daily average time spent for gaming (measured in hours), $f2p\_expense_i$ represents the total spending for F2P games by respondent i (measured in rupiahs), $income_i$ represents the average monthly earnings and/or allowance of respondent i, $expense_i$ represents the average monthly expense of respondent i (measured in rupiahs), age_i represents the age of respondent i (measured in years), $father\_education_i$ represents the length of education received by the father of respondent i (measured in years), $mother\_education_i$ represents the length of education received by the mother of respondent i (measured in years), $female_i$ is a dummy variable that takes the value of 1 if respondent i is female and 0 otherwise and u_i represents the error term. Note that we decided to assume the other gender as male because all 3 other respondents have a male-sounding name, and they only represent 0.77% of the sample size. We estimate Equation (7) using an OLS model, Equation (8) using a logit model, and Equation (9) using a probit model to get the following results, with their p-values in round brackets and odds ratio in square brackets (for logit models).

$$
\begin{aligned}
igd\_total_i = \beta_0 &+ \beta_1 gpa_i + \beta_2 game\_console_i + \beta_3 game\_variety_i \\
&+ \beta_4 game\_time_i + \beta_5 f2p\_expense_i + \beta_6 income_i \\
&+ \beta_7 expense_i + \beta_8 age_i + \beta_9 father\_education_i \\
&+ \beta_{10} mother\_education_i + \beta_{11} female_i + u_i
\end{aligned} \tag{7}
$$

$$
\begin{aligned}
igd_i = \Lambda(\beta_0 &+ \beta_1 gpa_i + \beta_2 game\_console_i + \beta_3 game\_variety_i \\
&+ \beta_4 game\_time_i + \beta_5 f2p\_expense_i + \beta_6 income_i \\
&+ \beta_7 expense_i + \beta_8 age_i + \beta_9 father\_education_i \\
&+ \beta_{10} mother\_education_i + \beta_{11} female_i + u_i)
\end{aligned} \tag{8}
$$

$$
\begin{aligned}
igd_i = \Phi(\beta_0 &+ \beta_1 gpa_i + \beta_2 game\_console_i + \beta_3 game\_variety_i \\
&+ \beta_4 game\_time_i + \beta_5 f2p\_expense_i + \beta_6 income_i \\
&+ \beta_7 expense_i + \beta_8 age_i + \beta_9 father\_education_i \\
&+ \beta_{10} mother\_education_i + \beta_{11} female_i + u_i)
\end{aligned} \tag{9}
$$

Table 5 summarized the impact of GPA and gaming, economic, and demographic factors on IGD. It can be seen that based on model (7), GPA has a significant negative impact on IGD score, as an increase in current GPA by 1 point is expected to decrease IGD score, on average, by 2.95 points, ceteris paribus. However, according to models (8) and (9), GPA is not a significant predictor of a person's IGD status, even at a 10% level of significance. Thus, while GPA may have a negative impact on a person's IGD score, its impact may not be economically significant as it does not seem to affect a person's probability to have IGD.

Moreover, all three models seem to agree that a person's gaming variety and gaming time have a significant positive impact on a person's IGD score or a person's probability of being diagnosed with IGD. This is rational, as a person's gaming behaviors should significantly impact a person's IGD score and status. Furthermore, while F2P expense is not a significant predictor of IGD score according to model (7), F2P expense has a significant positive impact on a person's probability to be diagnosed with IGD. This means that perhaps, F2P expense could be the variable that separates gamers who have significantly problematic gaming behaviors and those who do not. However, once we removed the variables that are not statistically significant, we can see from the model (8a) and (9a) that F2P expense is no longer a statistically significant predictor for IGD. As for gaming console owners, economic variables, and the demographic variables in all models conclude that they do not significantly impact a person's IGD score and status.

Table 5. Factors of Gaming Disorder – (7): OLS; (7a): OLS – GPA & Significant Only; (8): Logit; (8a): Logit – GPA & Significant Only; (9): Probit; (9a): Probit – GPA & Significant Only

Variable/ Model	(7)	(7a)	(8)	(8a)	(9)	(9a)
Constant	55.9891 (0.0000)***	54.4297 (0.0000)***	2.8638 (0.6033) [17.5288]	-4.4533 (0.0322)** [0.0116]	1.7274 (0.5366)	-2.3308 (0.0270)**
GPA	-2.9486 (0.0566)*	-3.6212 (0.0161)**	0.1720 (0.7859) [1.1877]	0.0635 (0.9141) [1.0656]	0.0671 (0.8317)	0.0160 (0.9577)
Game Console	-0.0886 (0.8820)		0.1633 (0.4258) [1.1774]	-	0.0757 (0.4796)	-
Game Variety	0.8652 (0.0011)***	0.9162 (0.0001)***	0.1532 (0.0656)* [1.1655]	0.1446 (0.0407)** [1.1556]	0.0771 (0.0709)*	0.0716 (0.0525)*
Gaming Time	1.5251 (0.0000)***	1.5946 (0.0000)***	0.1986 (0.0300)** [1.2197]	0.2165 (0.0082)*** [1.2417]	0.1057 (0.0252)**	0.1101 (0.0099)***
F2P Expense	0.0000002 (0.6495)	-	0.0000002 (0.0930)* [1.0000]	0.0000001 (0.1820) [1.0000]	0.00000009 (0.0882)*	0.00000006 (0.1592)
Income	-0.00000008 (0.7763)	-	-0.0000001 (0.4399) [1.0000]	-	-0.00000004 (0.5096)	-
Expense	-0.0000005 (0.1527)	-	-0.0000002 (0.4158) [1.0000]	-	-0.00000008 (0.3654)	-
Age	0.1145 (0.8398)	-	-0.3541 (0.1844) [0.7018]	-	-0.1948 (0.1499)	-
Father Education	-0.1897 (0.4003)	-	-0.0603 (0.5292) [0.9414]	-	-0.0425 (0.3322)	-
Mother Education	-0.0430 (0.8676)	-	0.0030 (0.9756) [1.0030]	-	0.0078 (0.8695)	-
Female	-2.1302 (0.1144)	-	0.0647 (0.9074) [1.0668]	-	0.0276 (0.9169)	-
R-Squared	0.2020	0.1856	-	-	-	-
F Statistics	8.7001 (0.0000)***	29.3253 (0.0000)***	-	-	-	-
Akaike Info Criterion	7.8035	7.7828	0.3953	0.3785	0.3941	0.3771
White Statistics	86.6898 (0.1886)	9.0815 (0.4298)	-	-	-	-
McFadden R-Squared	-	-	0.1750	0.1279	0.1778	0.1313
LR statistic	-	-	27.6100 (0.0037)***	20.1770 (0.0005)***	28.0595 (0.0032)	20.7230 (0.0004)***
Log likelihood	-	-	-65.0815	-68.7980	-64.8567	-68.5250
Percentage Gain (compared to naïve model)	-	-	11.10%	7.90%	10.98%	7.97%
Observations	390	390	390	390	390	390

The probit model has the lowest Akaike Info Criterion (AIC) values out of the three used models. Model (8) and (9) show that the probit model has a higher McFadden R-squared value and a higher LR statistic. Both models have also gained significant predictive advantages compared to a naïve model. In general, the probit and logit models tend to agree on the conclusions. Based on the logit model (8a), we can conclude that an increase in the game variety by 1 genre is expected to increase the probability of having IGD by 14.47% points, ceteris paribus. Moreover, growth in average daily gaming time by 1 hour is expected to increase the likelihood of having IGD by 24.17%, ceteris paribus. Thus, there is sufficient evidence to conclude that game variety and gaming time significantly impact IGD.

Impact of Internet Gaming Disorder and Other Factors on Academic Performance

Next, we want to estimate the impact of gaming disorder on academic performance. Consider Equation (10) to (14), where $\widehat{igd\_total_i}$ represents the estimated IGD total (based on instrument variables and exogenous variables), model (10) to (13) were estimated using OLS, while model (14) was calculated using 2SLS. Table 6 shows the estimated parameter values for model (10) to (14) with its p-values in round brackets and White heteroskedasticity-consistent p-values in square brackets for models that exhibit heteroskedasticity. Note that to test the endogeneity of IGD score in Equation (12), we estimated one extra model (12a) that includes the residual of regression of IGD on the game variety and gaming time. We call this residual "Residual1".

As presented on Table 6, we can see that by using OLS, we can conclude that internet gaming disorder score seems to have a negative impact on GPA, ceteris paribus. However, there is no significant difference in GPA between those diagnosed with IGD (by having an IGD score of 71 or above) and those who are not, ceteris paribus. Besides the IGD score, the only variables that are significant predictors of GPA according to the OLS models are income and gender. F2P expense is statistically significant when we use common standard errors, but once we take heteroskedasticity into account, F2P expense is no longer a significant predictor of GPA. In addition, according to model (12a), there is sufficient evidence to suggest that the IGD score is an endogenous variable in equation (12b).

In contrast, based on the 2SLS model (14), the IGD score has no significant impact on GPA. While we treat income and gender as exogenous variables, we use game variety and gaming time as IGD score instruments. This is because the game variety and gaming time significantly impact IGD scores individually, but they do not significantly impact GPA. Furthermore, since we do not reject the null hypothesis based on J-statistics's p-value, we can conclude that the over-identifying instruments are valid. On the other hand, the 2SLS model also concludes that income and gender are significant predictors of GPA. An increase in income by 1 million rupiahs is expected to increase GPA, on average, by 0.02 points, ceteris paribus. On average, women are expected to have a higher GPA than men, by 0.13 points, ceteris paribus.

$$gpa_i = \beta_0 + \beta_1 igd\_total_i + u_i \tag{10}$$

$$gpa_i = \beta_0 + \beta_1 igd_i + u_i \tag{11}$$

$$\begin{aligned} gpa_i = \beta_0 &+ \beta_1 igd\_total_i + \beta_2 game\_console_i + \beta_3 game\_variety_i \\ &+ \beta_4 game\_time_i + \beta_5 f2p\_expense_i + \beta_6 income_i \\ &+ \beta_7 expense_i + \beta_8 age_i + \beta_9 father\_education_i \\ &+ \beta_{10} mother\_education_i + \beta_{11} female_i + u_i \end{aligned} \tag{12}$$

$$\begin{aligned} gpa_i = \beta_0 &+ \beta_1 igd_i + \beta_2 game\_console_i + \beta_3 game\_variety_i \\ &+ \beta_4 game\_time_i + \beta_5 f2p\_expense_i + \beta_6 income_i \\ &+ \beta_7 expense_i + \beta_8 age_i + \beta_9 father\_education_i \\ &+ \beta_{10} mother\_education_i + \beta_{11} female_i + u_i \end{aligned} \tag{13}$$

$$\begin{aligned} gpa_i = \beta_0 &+ \beta_1 \widehat{igd\_total_i} + \beta_2 game\_console_i + \beta_3 game\_variety_i \\ &+ \beta_4 game\_time_i + \beta_5 f2p\_expense_i + \beta_6 income_i \\ &+ \beta_7 expense_i + \beta_8 age_i + \beta_9 father\_education_i \\ &+ \beta_{10} mother\_education_i + \beta_{11} female_i + u_i \end{aligned} \tag{14}$$

Table 6. Impact of IGD on GPA – (10): OLS – only IGD Score; (11): OLS – only IGD Status; (12): OLS – IGD Score and Other Factors; (12a): OLS - IGD Score and Other Factors (Significant Only) + Residual1; (12b): OLS – IGD Score and Other Factors (Significant Only); (13): OLS – IGD Status and Other Factors; (13a): OLS – IGD Status and Other Factors (Significant Only); (14): 2SLS

Variable / Model	(10)	(11)	(12)	(12a)	(12b)	(13)	(13a)	(14)
Constant	3.6000 (0.0000)***	3.3846 (0.0000)***	2.9917 (0.0000)*** [0.0000]***	3.4269 (0.0000)***	4.4170 (0.0000)*** [0.0000]***	2.8270 (0.0000)*** [0.0000]***	3.2569 (0.0000)***	3.3810 (0.0000)***
IGD Score	-0.0045 (0.0037)***	-0.0491 (0.5938)	-0.0033 (0.0566)** [0.0424]**	-0.0032 (0.0411)**	-0.0227 (0.0000)*** [0.0000]***	-	-	-0.0024 (0.5827)
IGD Status	-	-	-	-	-	0.0338 (0.7209) [0.6503]	-0.0073 (0.9359)	-
Game Console	-	-	-0.0009 (0.9635) [0.9668]	-	-	-0.0008 (0.9686) [0.9715]	-	-
Game Variety	-	-	0.0104 (0.2403) [0.3226]	-	-	-	-	-
Gaming Time	-	-	-0.0043 (0.6648) [0.7047]	-	-	-	-	-
F2P Expense	-	-	-0.00000002 (0.0630)* [0.2491]	-	-	-	-	-
Income	-	-	-0.00000002 (0.0297)** [0.0280]**	-	-	-	-	-
Expense	-	-	-0.000000007 (0.5490) [0.5247]	-	-	-	-	-
Age	-	-	0.0206 (0.2722) [0.2654]	-	-	-	-	-
Father Education	-	-	0.0108 (0.1485) [0.2729]	-	-	-	-	-
Mother Education	-	-	-0.0088 (0.3023) [0.3974]	-	-	-	-	-
Female	-	-	0.1237 (0.0056)*** [0.0034]***	-	-	-	-	-
Residual1	-	-	-	0.0231 (0.0000)*** [0.0000]***	-	-	-	-
R-Squared	0.0215	0.0007	0.0716	0.0518	0.1277	0.0630	0.0415	0.0510
F Statistics	8.5092 (0.0037)***	0.2849 (0.5938)	2.6517 (0.0028)***	7.0263 (0.0001)***	14.0957 (0.0000)***	2.3094 (0.0095)***	5.5687 (0.0010)***	5.7233 (0.0008)***
Akaike Info Criterion	0.9945	1.0155	0.9932	0.9733	0.8949	1.0024	0.9841	-
White Statistics	1.5556 (0.4594)	1.1152 (0.2910)	112.6149 (0.0041)***	3.1183 (0.9267)	21.0271 (0.0724)*	112.4151 (0.0034)***	1.9144 (0.9644)	3.1990 (0.9213)

(continued)

Table 6. (continued) Impact of IGD on GPA – (10): OLS – only IGD Score; (11): OLS – only IGD Status; (12): OLS – IGD Score and Other Factors; (12a): OLS - IGD Score and Other Factors (Significant Only) + Residual1; (12b): OLS – IGD Score and Other Factors (Significant Only); (13): OLS – IGD Status and Other Factors; (13a): OLS – IGD Status and Other Factors (Significant Only); (14): 2SLS

Variable / Model	(10)	(11)	(12)	(12a)	(12b)	(13)	(13a)	(14)
Instrument Variables	-	-	-	-	-	-	-	constant, game variety, gaming time, income, female
J Statistics	-	-	-	-	-	-	-	0.9094 (0.3403)
Observations	390	390	390	390	390	390	390	390

Therefore, based on the 2SLS model, we conclude that IGD does not hinder academic performance. We used the 2SLS model because it considers regressor endogeneity and found the over-identifying instruments to be valid.

DISCUSSION

When we use the OLS model, we found that GPA has a significant negative impact on IGD score. This finding is consistent with the result concluded by Hawi et al. (2018). However, when we replace the dependent variable from IGD score (as a continuous variable) with IGD status (binary variable), we found GPA to be a non-significant factor of IGD. This might show that while GPA could be a contributing factor in a decrease of IGD, it is not the main factor that separates those who have problematic gaming behaviors and those who are just casual gamers. Meanwhile, gaming hours and gaming variety are significant factors of IGD, which is reasonable.

Similarly, when we use the OLS model, we found the IGD score to be a significant predictor of GPA, besides gender and income. However, when we use a 2SLS model, with gaming hour and game variety as valid over-identifying instruments of IGD, we found IGD to have no significant impact on GPA. Since IGD is proven to be endogenous in the OLS model, we conclude based on the 2SLS model that IGD has no considerable effect on GPA, therefore giving evidence that despite the students' gaming intensity, they are still responsible for their academic performance. This is consistent with Fabito et al. (2018), who found no evidence of game addiction as a causal factor for academic performance. Instead, gender is proven to be the most significant predictor of GPA based on these Indonesian university students' data. Interestingly, based on our data, our research shows that female students are outperforming male students, even though young women (20 to 30 years old) are earning significantly less than men in Indonesia, ceteris paribus (Karnadi, 2019).

As our sample was limited to undergraduate students, future research may want to investigate Internet Gaming Disorder's prevalence in primary or secondary school students. Indah et al. (2018) argue that compulsive Internet use is a problem faced by most high school students. Further studies on cognitive behavior therapy (CBT) is also of interest to anticipate the possible negative effects of IGD that may arise eventually. For instance, Situmorang et al. (2018) gave evidence that CBT effectively mitigates academic anxiety.

Our results show that gaming time and game variety have a significant impact on IGD score and status. Easier access to technology, which arguably can increase a gamer's gaming time and game variety, is one factor that can increase an adolescent's likelihood to become addicted to video games (Novrialdy & Atyarizal, 2019). Thus, school counselors need to pay more attention to students' access to video games and the time they normally spend on gaming to be able to prevent addiction. School counselors can make several prevention efforts by providing seminars, more socialization about IGD, and preparing IGD addiction hazard modules.

There is room for improvement in treatments for IGD, as some studies still have methodological flaws (Zajac et al., 2017). One treatment program that has been created to treat adolescents with IGD is the PIPATIC (Programa Individualizado Psicoterapéutico para la Adicción a las Tecnologías de la información y la comunicación) program. Torres-Rodríguez et al. (2018) designed PIPATIC as a manualized intervention program for teenagers with IGD. The PIPATIC program is structured into six modules, namely psychoeducational, usual treatment, intrapersonal treatment, interpersonal treatment, family intervention, and development of a new lifestyle. Torres-Rodríguez et al. (2018) explain that the PIPATIC program has shown positive preliminary effects.

CONCLUSION

In conclusion, we found 5.13% of our respondents to have IGD. We concluded that gaming time and gaming variety significantly impact a person's IGD score or status. Finally, we found that once we consider endogeneity, we found IGD to be an insignificant predictor of GPA, ceteris paribus. Instead, we found income and gender to have a significant impact on GPA. Thus, we would recommend policymakers to spend less time banning video games for kids and worrying more about other issues such as poverty and gender equality. We would also recommend educational institutions to recognize that gaming addiction is a real issue. However, other factors are more significant when it comes to improving academic performance. Finally, this research is not without its limitations, as there are unobserved variables in our models that can perhaps significantly affect academic performance, such as their approach to learning, number of siblings, stigma associated with female education/achievements, social skills, parents' attitude towards gaming and psychological variables. Future research should look deeper into how perhaps these new variables may impact the relationship between gaming disorder and academic performance.

REFERENCES

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*. American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425596

Cheng, C., Cheung, M. W.-L., & Wang, H. (2018). Multinational comparison of internet gaming disorder and psychosocial problems versus well-being: Meta-analysis of 20 countries. *Computers in Human Behavior, 88*, 153–167.

Dumrique, D. O., & Castillo, J. G. (2018). Online gaming: Impact on the academic performance and social behavior of the students in Polytechnic University of the Philippines Laboratory High School. *KnE Social Sciences*, 1205–1210.

Fabito, B. S., Rodriguez, R. L., Diloy, M. A., Trillanes, A. O., Macato, L. G. T., & Octaviano, M. V. (2018). Exploring mobile game addiction, cyberbullying, and its effects on academic performance among tertiary students in one university in the Philippines. *TENCON 2018-2018 IEEE Region 10 Conference*, 1859–1864.

Gough, C. (2019). *Number of video gamers worldwide 2014-2021*. Statista https://www. Statista. com/ statistics/748044/number-Video-Gamersworld, 7, 2020.

Hawi, N. S., Samaha, M., & Griffiths, M. D. (2018). Internet gaming disorder in Lebanon: Relationships with age, sleep habits, and academic achievement. *Journal of Behavioral Addictions, 7*(1), 70–78.

Icekson, T., Kaplan, O., & Slobodin, O. (2019). Does optimism predict academic performance? Exploring the moderating roles of conscientiousness and gender. *Studies in Higher Education, 45*(3), 635–647.

Indah, Y. F. K., Lasan, B. B., & Ramli, M. (2018). The effectiveness of transtheoretical model to reduce compulsive internet use of senior high school students. *Jurnal Kajian Bimbingan dan Konseling, 3*(1), 1–13.

Jakarta Globe. (2019). *Squad up: Indonesia considers ban on PUBG.*

Karnadi, E. B. (2019). Is there any discrimination towards young women in Indonesia's labor market? *International Research Journal of Business Studies, 12*(1), 69–86.

Király, O., & Demetrovics, Z. (2017). Inclusion of gaming disorder in ICD has more advantages than disadvantages: Commentary on: Scholars' open debate paper on the World Health Organization ICD-11 Gaming Disorder proposal (Aarseth et al.). *Journal of Behavioral Addictions, 6*(3), 280–284.

Kuss, D. J., Griffiths, M. D., & Pontes, H. M. (2017). Chaos and confusion in DSM-5 diagnosis of Internet Gaming Disorder: Issues, concerns, and recommendations for clarity in the field. *Journal of Behavioral Addictions, 6*(2), 103–109.

Lu, M., Walsh, K., White, S., & Shield, P. (2017). The associations between perceived maternal psychological control and academic performance and academic self-concept in Chinese adolescents: The mediating role of basic psychological needs. *Journal of Child and Family Studies, 26*(5), 1285–1297.

Mallett, J. (2009). Academic integration, academic performance, and retrospective evaluations of own performance: The relationships with global self-esteem among Northern Irish university students. *The Irish Journal of Psychology, 30*(3-4), 185–199.

Novrialdy, E., & Atyarizal, R. (2019). Online game addiction in adolescent: What should school counselor do? *Jurnal Konseling dan Pendidikan, 7*(3), 97–103.

Paver, B., & Gammie, E. (2005). Constructed gender, approach to learning and academic performance. *Accounting Education: An International Journal, 14*(4), 427–444.

Pontes, H. M., Kiraly, O., Demetrovics, Z., & Griffiths, M. D. (2014). The conceptualisation and measurement of DSM-5 Internet Gaming Disorder: The development of the IGD-20 Test. *PloS One, 9*(10), e110137.

Reysen, R. H. (2013). *The relationship between academic entitlement, academic performance and satisfaction with life in a college student population.*

Palummo, C., Pocai, B., Steardo Jr, L., Bhugra, D., & Fiorillo, A. (2018). Is internet gaming disorder really a new form of mental disorder? A critical overview. *Journal of Psychopathology*, (3), 141–147.

Scerri, M., Anderson, A., Stavropoulos, V., & Hu, E. (2019). Need fulfilment and internet gaming disorder: A preliminary integrative model. *Addictive Behaviors Reports, 9*, 100144.

Situmorang, D. D. B., Mulawarman, M., & Wibowo, M. E. (2018). Integrasi konseling kelompok cognitive behavior therapy dengan passive music therapy untuk mereduksi academic anxiety, efektifkah? *Jurnal Kajian Bimbingan dan Konseling, 3*(2), 49–58. https://doi.org/10.17977/um001v3i22018p049

Stavropoulos, V., Anderson, E. E., Beard, C., Latifi, M. Q., Kuss, D., & Griffiths, M. (2019). A preliminary cross-cultural study of Hikikomori and internet gaming disorder: The moderating effects of game-playing time and living with parents. *Addictive Behaviors Reports, 9*, 100137.

Torres-Rodríguez, A., Griffiths, M. D., & Carbonell, X. (2018). The treatment of internet gaming disorder: A brief overview of the PIPATIC program. *International Journal of Mental Health and Addiction, 16*(4), 1000–1015.

Triberti, S., Milani, L., Villani, D., Grumi, S., Peracchia, S., Curcio, G., & Riva, G. (2018). What matters is when you play: Investigating the relationship between online video games addiction and time spent playing over specific day phases. *Addictive Behaviors Reports, 8*, 185–188.

Van Den Brink, W. (2017). ICD-11 Gaming Disorder: Needed and just in time or dangerous and much too early? Commentary on: Scholars' open debate paper on the World Health Organization ICD-11 Gaming Disorder proposal (Aarseth et al.). *Journal of Behavioral Addictions, 6*(3), 290–292.

Wichstrøm, L., Stenseng, F., Belsky, J., von Soest, T., & Hygen, B. W. (2019). Symptoms of internet gaming disorder in youth: predictors and comorbidity. *Journal of Abnormal Child Psychology, 47*(1), 71–83.

World Health Organization. (2018). Gaming Disorder. https://www.who.int/features/qa/gaming-disorder/en/

Wright, J. (2011). The effects of video game play on academic performance. *Modern Psychological Studies, 17*(1), 37–44.

Zajac, K., Ginley, M. K., Chang, R., & Petry, N. M. (2017). Treatments for internet gaming disorder and Internet addiction: A systematic review. *Psychology of Addictive Behaviors, 31*(8), 979–994.