Proceedings of Science and Mathematics
Faculty of Science, Universiti Teknologi Malaysia
Vol. 9, 2022, page 201-210

Structural Equation Modelling on Effect of Online Gaming Addiction on Academic Performance among Universiti Teknologi Malaysia Students

Muhammad Badrul Amin Ayop*, Muhammad Hisyam Lee
Department of Mathematical Sciences, Faculty of Science,
Universiti Teknologi Malaysia, 81310 Johor Bahru, Malaysia
*Corresponding author: badrul-1999@graduate.utm.my, mhl@utm.my

Abstract
In this study, the structural equation modelling (SEM) methods was developed to assess a model that hypothesised the effects of online gaming addiction (OGA) on academic performance in the group of Universiti Teknologi Malaysia students. The SEM was developed to link all the study variables, and a discussion was provided to explain how they are related to one another. SEM are using variance in the analyses as a parameter to each variable connected. This study was conducted by using survey method to obtain feedback with Google Form as a flatform for questionnaires and rolling the survey over the social media platforms to UTM students. The analyses for SEM divided to males and females to see the level of addiction. The question asked about the amount of time, in hours, that they spend playing video games online on a daily, weekly, and for the first time playing online gaming, as well as the amount of time that they spend studying in hours. The scale of online gaming addiction, 10-items are determining the extent to which addiction affects students' academic performance. The result shows that OGA on academic performance have weak negative relationship on academic performance, For the male have weak negative relationship between OGA and academic performance but the result for female OGA has positive relationship on academic performance.

Keywords: Structural Equation Model, Online Gaming Addiction, Time Management, Academic Performance

1. Introduction

Online gaming has become a popular activity, especially among young people, due to high equipment (computers, tablets, and smartphones) and the growing penetration of the internet. In Malaysia, the rapid development of the internet these days, the Malaysian online gaming sector is expected to expand in the approaching time zone which has led to an increase in online gaming activities and is predicted to help the Malaysian online gaming industry develop significantly. Penetration of the Internet has increased the population's keen lots of high investing on entertainment time activities. In addition, the country hosts several digital platform-based gaming tournaments, and with so much going on for the industry's growth, the Malaysian online gaming market's industrial competitive landscape is expected to flourish with superstitious growth prospects in the time zone extending to 2027.

Video games have been a popular form of entertainment for people of all ages for decades. In recent years, video game effects have spread around the world [1]. Several video game research findings are considered seriously, whereas others identify video game addiction and discriminate against these video games [2], [3] "Internet gaming disorders" are characterised as video game addiction that is difficult to manage and is claimed to reflect impulse control difficulties as well as gambling addiction. There is no authoritative declaration on behavioural addiction testing and diagnosis. [2] and the scope of these research is limited [3]. The multiple negative impacts of its introduction to computer games, such as aggressive adventure games, i.e., addiction [4].

Nowadays, youths, as well as adults, who are active, spend a lot of time playing video games. Especially when university students are extremely exposed to smartphones as well as laptops or PCs and the internet since they are entering the field of education at the degree level. According to [3] 95 percent of Internet users have a university or undergraduate. Among the younger generation, online games have grown in popularity worldwide, resulting in an increase of addiction to online gaming. Without a doubt, online gaming is one of the most addicting Internet activities nowadays [5]. The rate of online requirements served is increasing, as is the people are spending more time on the internet and online video game.

The reality that online gaming addiction is already recognized as a mental disorder by the World Health Organization (WHO) [6] both provide information regarding the case's presence and prevalence, as well as being shown as a major move forward in the recognition of other technology addictions. Addiction to video games and the internet has also been related to mental health issues [7]. Therefore, it may be claimed that studies on internet addiction and online video games, as well as the concepts that are linked with them, are relevant.

2. Literature Review

Online video games are a popular flatform that has recently been a serious challenge, particularly among students, because they have the potential to lead to addiction [8]. Internet Gaming Addiction (IGA) is a mental disorder that has been discovered and defined in a variety of ways. In general, technology addiction has a maladaptive psychological component, while adaptation varies depending on the sorts of online games. Games that provide various types of obsessives-compulsive personality behaviors that may attract a player to the point of abandoning their main responsibilities in life. [9] suggest that pathological use of the Internet is the consequence of "problematic cognitions combined with maladaptive behaviors". Maladaptive cognitions include self-doubt, low self-efficacy, and a negative view of oneself. Examples of self-cognitive thinking include "I'm useless offline, but online is better to have a conversation because nobody does know who I am in reality".

In addition, males spend more time gaming each day than females [10]. Male aggression may be viewed more normal and acceptable from a sociocultural aspect. Some game creators target males as the targeted customers of violent and adventurous online games. Males would consider competitive game structures more interesting, because they may gain sensations of accomplishment from gaming. [11] found that the majority of young adult participants in a problematic gaming group were male. Online video gaming is an uncontrollable environment for the younger generation because of the possibility for maximal interaction and excitement. Internet gaming has become one of the most addictive Internet hobbies, with some experts even classifying it as a subtype of Internet addiction [4]. Prior studies have shown that men use the internet at a much higher rate than women. [12] said in their paper that males are more addiction than females since the BMI for males are higher than females. Internet gaming usage excessively has been linked to poor self-control and less than satisfactory academic performance [13].

Structural Equation Modelling, a statistical technique, was developed over a decade ago but has only recently grown in popularity. SEM enables the creation of a validation model or hypothesis test by describing the model to be evaluated against the research data [14]. SEM is a useful tool for analyzing non-experimental data and can be used to investigate causal relationships in the data. Exploratory procedures should be conducted with caution since the model should not be considered a realistic representation of real-world events and states [15]. CB-SEM is based on the core validation model of Spearman's work on general intelligence in 1904, which Spearman claimed that general intelligence is the common factor that he incorporated into his actual scoring model. A theoretical factor models with structured relationships were created with the help of factor analysis, econometric measures, and pathway models. The author can calculate the effect of observed values on factors in the Influence variable model given an estimated set of parameters and new case values or observed variables, or even without empirical data. [16] recently found that CB-SEM parameters can be highly biased if they are applied (incorrectly) to data from a set of composite models. This shows that the SEM approach is different and cannot be changed even if isolating the correlation decisions. The problem is solved by

using Bootstrapping (typically 5,000 samples) to obtain standardized estimates of model parameters, allowing for simpler significance testing.

The Game Addiction Scale (GAS) has two versions, the long interpretation contains 21 specifics, and the short interpretation contains seven. Each of the seven items in the GAS is rated on a five-point Likert scale, ranging from 1 (none) to 5 (very often). The GAS had a satisfactory internal consistency (* = 0.85; [17]) and its validity was confirmed by its correlation with time spent on games. The purpose and objectives of the research should be included in the questionnaire. Open-ended questions, for instance, are useful for gathering demographic data and other information based on facts that can be used to classify people or situations. A survey should generally be as short as possible, but the average respondent can answer 3 multiple-choice questions in one minute.

3. Methodology

3.1. Description of the Data and Method

In this study, a questionnaire was designed using Google Form, the data collection using online questionnaire survey method. The link for Google Form was sent through social media such as WhatsApp groups and telegram groups connected to UTM students. The data collection is randomly collected from various students on different faculties at UTM. Sample size target the feedback from UTM students from different faculties. The questions detailed in inquiring about their professional whereabouts and the identity of this survey's participants will be kept confidential.

3.2. Population and Sampling Procedure

Students from UTM's Skudai campus were chosen as the sample population for this study because we were looking into the effect online video game addiction has on academic performance. Consequently, UTM students were good candidates for the study. In addition to that, UTM students are easier to reach than students at other universities. The Data will collect after the questionnaire start spread out in 2 weeks.

The study applied a network sampling method. One of the network sampling methods are social media such as WhatsApp, Telegram and Facebook as example. Other communications, such as calls and emails, have progressively been overtaken by social media platform [18] The idea for data collection is an online questionnaire was distributed through various WhatsApp groups such as sharing in UTM E-sport club organization's WhatsApp group and the MPP-Student service (UTM) Telegram group since the data collection period coincided with online learning at university and some students were not returned to campus at that moment. Hence, it was not possible to reach the students directly. Furthermore, [19] mentioned that the network sampling procedure can be used since it is an important statistical technique and can help to provide solutions to difficulties related to physical accessibility. PLS-SEM and CB-SEM will be used to analyze the samples depending on the respondents.

3.3. Pilot Test

Tests sample questionnaire will be conducted to test the reliability of the questions and identify weaknesses in the design as reviewed by experts before the real study was conducted. As an early strategy to see the standards of the study, the test provided is expected to have 50 respondents. A questionnaire will be presented to certain students who have played online games to see their academic performance in CGPA and level addiction towards online video games with their background of faculty, age, and years of study. Hence, in order to conduct a full-scale study, a pilot study must be conducted as a small sample version [20]. Reliability as consistency, stability, predictability, and accuracy. Cronbach's alpha measures internal consistency. Cronbach's alpha can be 0-1. 0 means no consistency variance, and 1 means all variances are consistent. Higher Cronbach's alpha indicates greater reliability. 0.65 to 0.8 Cronbach's alpha is adequate for human dimension research. Table 3.1 shows Cronbach's alpha reliability.

Table 1 The value of Reliability Cronbach's Alpha

Alpha Coefficient Value	Level of Realibility
α ≥ 0.9	Excellent
0.8 ≤ α < 0.9	Very Good
0.7 ≤ α < 0.8	Good
0.6 ≤ α < 0.7	Moderate
α < 0.6	Poor

3.4 Equation of PLS-SEM

The main disadvantage of the SEM Method is that it uses a small sample. Also, it is not possible to obtain the same results with multiple observed variables. In contrast, with the CB-SEM method, the relationship between the observed variables and the composite is more simple. Let *C* as a composite of *p* weighted variables x_i (*i*=1, *p*), i.e.,

$$C = \sum_{i=1}^{p} W_i X_i \quad (1)$$

Where the $w_i s$ are amounts to be multiplied by each variable before adding them to the composite. Then, the variance of the composite *C* is given by

$$\sigma_c^2 = \sum_{i=1}^{p} W_i \sigma_i^2 + 2 \sum_{i=1}^{p} \sum_{j=1}^{i-1} W_i W_j \sigma_{ij} \quad (2)$$

Where σ_i^2 is the variance of x_i and σ_{ij} (*i*=1 to *p, j*=1 to *i, i≠j*) the covariance between different indicator x_i and x_j ([20], equation 3.21, p. 83). The sum of the components' variances is equal to the sum of their covariances, which are adjusted by the weights. As a result, the composite is more reliable and is more strongly associated with a particular criterion. The more diverse the composite's components are, the more reliable they will be. This will help explain the statistical model's real-world phenomenon [21].

3.5 Data Analysis

PLS is a method that uses variance-based and covariance-based techniques similar to the conventional SEM method (CB-SEM). With PLS, the objective is to predict the dependent, real, and potential variables, while minimizing the equilibrium variance (R^2) in the dependent variable. Multicollinearity between independent variables is overcome with this method, which makes it a good choice when conducting exploratory research in cross-sectional surveys. Model comparisons may be more difficult in PLS as there are no global optimization criteria. PLS used primarily as a method settler, primarily because of its excellent accuracy for prediction. It is robust to different scale types and does not require distributional assumptions. A minimum sample size of ten times the maximum number of latent variables is recommended, and 50 reported cases is adequate for a small model. This is an advantage over CB-SEM, which typically requires a large number of cases, especially if the model is becoming increasingly complex [18].

3.6. Statistical and Fit Indices in SEM

While several procedures are taken to verify the SEM model, the author trying will concentrate on the most relevant aspects and explore them in depth for this study. Before moving on to the following part, the different fit indices and their thresholds are summarized. The absolute fit index is generated from the obtained fit, which implies the covariance matrix. Exact fit implies that the suggested model matches the best of all available models and determines the match between the sample and the preceding data model. With a zero model, these metrics are tested by adding, comparing, or comparing relative fitness models. This is known as comparison because of its nature. The Parsimonious Fit Index is one of the two categories mentioned above. Simplicity is rewarded, while complexity is penalized [20]. This is a typical way of comparison.

3.7 Fit Indices

a) *Chi-Square*

The model's overall suitability is determined using the chi-square value. It computes the difference between the sample and the model's covariance matrix. This is generally recognised

as a metric of badness. At a rate of 0.05, it will reflect a lower significance value. Its importance will expand as a result of a huge sample size and a variety of indicators. Other qualification indications must be explored before selecting. It shows the chi-square of the degrees of freedom clearly.

b) *Goodness-of-Fit Statistics*

It alternative about the chi-square test. It calculates the fraction of variance given by the population's estimated covariance. 0 to 1 is the range of it. The frequently suggested threshold is 0.90 usually, however it should be higher than 0.95 for small samples and lower factor loadings.

c) *Adjusted Goodness-of-Fit Statistics*

AGFI is the derivative from GFI. It works to adjust the degree of freedom in GFI. For example, sum of square are using in GFI but AGFI are using mean square. 0 to 1 is the range using in AGFI. The most suggested threshold is 0.90. In addition, the value for AGFI is >0.80.

d) *Normed Fit Index*

This index calculated the model's chi-square value by comparing it to the identical null model or independence model. The null model assumes that all the measured variables/indicators are uncorrelated, which is typically the worst-case situation. As a result, NFI may be used to measure progress. A score of 0.90 or above indicates a satisfactory model fit. > 0.95 was indicated in certain research. However, sample size has a strong influence on this, therefore it cannot be evaluated alone.

e) *Comparative Fit Indices*

Redesigned Normed fit index (NFI) to deal with a limited sample size. The model fit is also compared to a null or independent model. The important distinction is that it discusses hidden components rather than indicators. [18] imply an excellent model fit (exact as NFI) when the threshold value is 0.90 (>0.95 in small samples). It is one of the most often used SEM indexes.

f) *Root Mean Square Error of Approximation*

The model regarded as the most trustworthy source of information and commonly uses the fewest parameters to fit the final population covariance matrix. To put it another way, a good model fit should have an RMSEA of less than 0.08.

3.8 Hypothesis Framework SEM

H_0: Online gaming addiction has positive effect on academic performance.
H_1: Online gaming addiction has negative effect on academic performance.

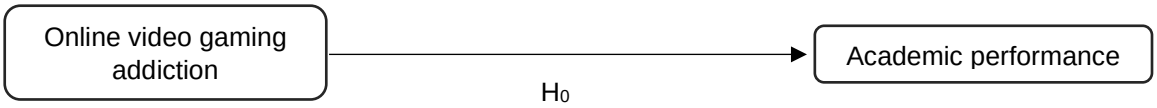

Figure 1: Conceptual Framework Structural Equation Modelling

4. Results and Discussion

4.1. Data collection and instrument

The developed survey was applied to 182 UTM students who stated that they played online games via social media such as Telegram and WhatsApp. The survey was conducted at the UTM Skudai in

Johor, Malaysia. In section 4 about time management on time spends on internet, study and socialize. Ten questions in Section 5 tried to measure how much students were addicted to online games.

The factors included in the proposed model are exposure to online video games, exposure to online gaming, time management, habit, and intention to play. The survey was originally conducted to 50 students in order to test the dependability of the data gathering instrument and if the questions were clear. The results of the reliability test are presented in Table 4.1 as shown for Cronbach's Alpha (a) coefficient. The items for addiction were determined as 0.849. For the actual study, addiction was determined as 0.872 was very good after the data obtained from 182 students.

Table 2: Reliability Test for Online Gaming and Academic Performance

Variables	**No. of Items**	**Cronbach's Alpha**		
		Pilot Study (*N* = 50)	**Actual Study (*N* = 182)**	**Level of Reliability**
Addiction	10	0.849	0.871	Very Good

Table 2 shows games experience among students by the survey. The students estimated start playing online video games more than 5 years (36.8%) which is the second highest from 1-5 years (43.4%) and the following 6 months-1 year (21.1%) and less than 6 months (7.7%). The daily spent playing online video games in a week 3 days (28.0%) is the highest and following the rest 7 days (22.7%), 6 days (3.3%), 5 days (10.4%), 4 days (8.2%), 2 days (14.8%) and a day per week (12.6%). The amount of time spends on playing online video games for 1 to 3 hours (56.0%) per day is the highest and less than an hour (7.7%) is the lowest and following to the others 3 to 6 hours (25.3%) and more than 6 hours (11.0%).

Table 3: Gaming experience among UTM students (*N*=182)

Gaming parameter	**Frequency (n)**	**Percentage %**
Estimated time since first playing online video games		
Less than 6 months	14	7.7
6 months–1 year	22	12.1
1 year–5 years	79	43.4
More than 5 years	67	36.8
Daily spent playing online video games in a week		
1 day	23	12.6
2 days	27	14.8
3 days	51	28.0
4 days	15	8.2
5 days	19	10.4
6 days	6	3.3
7 days	41	22.7
The amount of time spends on playing online video games per day		

Less than an hour	14	7.7
1 to 3 hours	102	56.0
3 to 6 hours	46	25.3
More than 6 hours	20	11.0

4.2 Results

a) **Descriptive Statistic**

A summary of model SEM result are present on Table 4. The result for the model study sample (n=182) are $\chi 2$ = 105.866, p = .000, GFI = 0.906, AGFI = 0.859, CFI = 0.916, NFI = 0.866, RMR = 0.031, and RMSEA = 0.088. The result for the gender in Table 4.6 shows for male (n=107) are $\chi 2$ = 84.546, p = 0.000, GFI = 0.828, AGFI = 0.828, CFI = 0.828, NFI = 0.808, RMR = 0. 0.039, and RMSEA = 0.093, for female (n=75) are $\chi 2$ = 74.114, p = .000, GFI = 0.852, AGFI = 0.779, CFI = 0.919, NFI = 0.827, RMR = 0.037, and RMSEA = 0.096 given the recommended value showed in Table 4.6 that GFI, AGFI and RMR and CFI have a good fit, NFI was not a good fit and RMSEA have a moderate fit.

Table 4: Summary of Hypothesized Measurement Model Fit Statistic Study Variable

Fit Indices	**Authors**	**Recommended Value**	**Result Value**		
			Overall	Male	Female
χ^2			105.866	84.546	74.114
p-value	Wasserstein	<0.05	0.000	0.000	0.000
GFI	Chau, 1997; Segar&Grover,1993	>0.90 >0.90	0.906	0.828	0.852
CFI	Bentler, 2001 Hatcher, 1994	>0.90 >0.90	0.916	0.895	0.919
RMSEA	Bryne,2001 Hu & Bentler, 1999 Meyers et. al, 2005	<0.08 <0.05 <0.8: good fit; 0.8 to 1: moderate fit; >0.1: poor fit	0.088	0.093	0.096
RMR	Hair et. al, 2009	<0.09	0.031	0.039	0.037
NFI	Bentler & Bonett,1980	>0.90	0.866	0.808	0.827
AGFI	Hair et al, 2009	>0.80	0.859	0.828	0.779

The path in Figure 2 from online gaming addiction (OGA) to student academic performance (CGPA) (-1.00). This path suggests that academic performance drops by 1.0 of a standard deviation for every standard deviation increase in online gaming addiction. As a result, it seems that OGA negatively affects student academic performance.

The pathway in Figure 4.2 from online gaming addiction (OGA) to student academic performance (CGPA) is depicted for the male model (-1.00). This correlation suggests that academic performance decreases by 1.0 standard deviations for each standard deviation of online gaming addiction. Therefore, it appears that OGA has a negative effect on student academic performance.

The pathway in Figure 4 from online gaming addiction (OGA) to student academic performance (CGPA) is depicted for the female model (1.00). This correlation suggests that academic performance increases by 1.00 standard deviations for each standard deviation of online gaming addiction. Therefore, it appears that OGA has a positive effect on student academic performance.

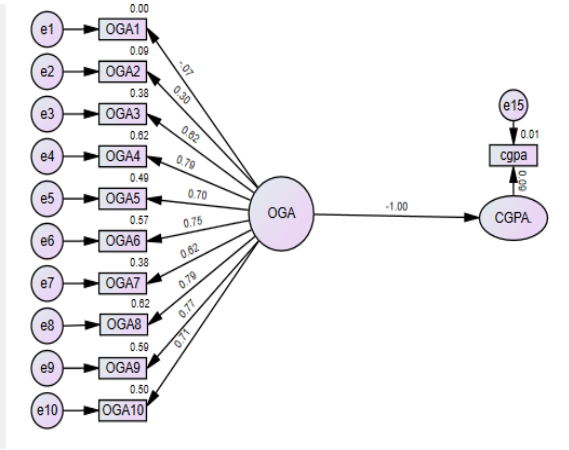

Figure 2: Structural Equation Modelling (SEM) Online Gaming Addiction using the Student CGPA as the Dependent Variable (actual data)

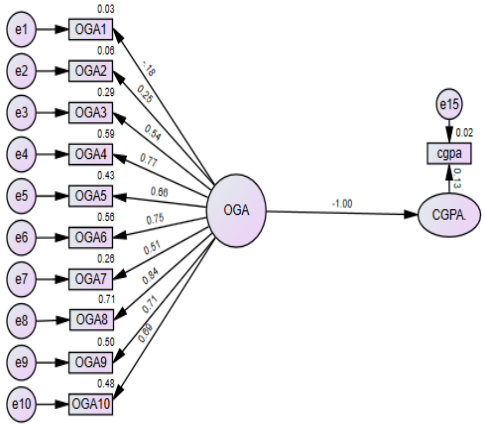

Figure 3: Structural Equation Modelling (SEM) Online Gaming Addiction using the Student CGPA as the Dependent Variable for Male.

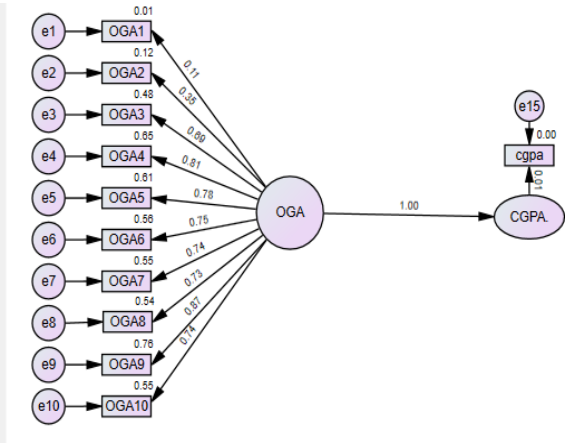

Figure 4: Structural Equation Modelling (SEM) Online Gaming Addiction using the Student CGPA as the Dependent Variable for Female.

The hypotheses were supported in Table 5 only H_0 for female, online gaming addiction have a significant effect academic performance, hence H_0 were accepted. For overall study and male, H_0 were rejected since online gaming addiction have significant negative effect on academic performance, H_1.

Table 5 Results of hypotheses tests

Hypothesis		Rejection		
		Male	Female	Overall
H_0	Online gaming addiction have positively affected on academic performance	Reject H_0	Accept H_0	Reject H_0

H_0: Online gaming addiction has positive effect on academic performance.

H_1: Online gaming addiction has negative effect on academic performance.

Conclusion

UTM students are better to visualized and understood. From the analysis, it reveals that UTM student are not addicted to online gaming. The rate for gaming addiction of UTM students for playing "more than 6 hours" is 11.0% which is low percentage. The study also proves that the online gaming addiction affect the CGPA at high value for variance which is it almost the value of 1.0 for female but for overall there its shows negative value for variance.From the analysis, some fit indices in this study are not have a good fit. The result for GFI, CFI, RMSEA, RMR, and AGFI were more than recommend value but for NFI and RMSEA shows the value were not satisfied to the recommended value for different analysis for male, female, and the total of respondents.

In general, the SEM model for this study is not justified the result of the study which is the relationship between online gaming addiction and academic performance were not supported our hypothesis which is the result of variance are negative value. For females about online gaming addiction and academic performance shows the hypothesis are accepted which is the value of variance are positive. From the perception of UTM students shows that they are not addicted to online gaming, the average for addiction scale which is scale 4 and scale 5 shows that only scale 3 (28.30%) and scale 4 (17.87%) UTM students are addicted to online gaming. The analysis can be justified the addiction to online gaming are low. Then, to conclude the level of addiction UTM students, in the hypotheses for overall data shows the result is negative, so UTM students are not addicted to online gaming.

Acknowledgement

The researcher would like to thank all people who have supported the research.

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