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Research Methodologyin the Development of a Model for Digital Games Acceptance in Malaysia

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Abstract: This paper provides an overview of the research methodology which is utilized in the development of digital games acceptance model in Malaysia. This model is useful to Malaysian entertainment digital games industries which are looking for niche market in Malaysia and exploring potential market in the Asia Pacific region. This chapter outlines specific investigative plan of action linking methods to outcomes. Research design, sampling frame, research methods, instrument development, the administration of the survey, data collection, analysis procedures and pilot test are discussed in this paper.

Key words: Digital games · Research methodology · Digital games acceptance · Malaysia's digital gamer

INTRODUCTION

Malaysian Government is interested in leveraging on digital games and creative industries to build its economy. Unlike conventional application of ICT, digital games provide a new dimension containing elements of interactivity and reciprocal communication in the virtual world [1]. They lay out a new challenge to conventional society's view of culture and technology. The developments of digital games follow Maslow's hierarchy of needs. Initially, a digital gamer plays a digital game either to pass the time or as a means of relaxation. That is to satisfy his/her basic need to relax and to entertain himself/herself. With time, the digital game becomes a challenge which he/she has to overcome for his/her emotional fulfillment. Hence, digital games nourish all the human impulses, in line with the way the natural human mind has been created, to get the task done [2].

At the present moment, more than 75 % of digital games revolve around the entertainment industries or the manufacturing industries as serious games (or simulators) for training and testing purposes. As digital games are increasingly used for education, it has become imperative to measure the attributes of acceptance and engagement for digital games extended to the features of knowledge, challenge, attentiveness, clearness of the goal, feedback, involvement and freedom [3].

Games are organized play. This is described and referred to byPrensky [4] in the Encyclopedia Britannica. According to Prensky, digital games have twelve characteristics. They are:

- Fun which offers enjoyment and pleasure,
- Play which gives intense and passionate involvement,
- Rules which offers structure,
- Goals which gives motivation,
- Interactivity which presents the opportunity to manipulate thing and take action,
- Adaptive which offers flow experience,
- Outcomes and response which offers learning
- Win situations which offers ego,
- Challenge which offers adrenaline rush,
- Problem solving which offers sparks from latent creativity
- Interaction which offers social groups team working and
- Story which offers exposure to emotion.

Needless to say, long before digital games existed, games and simulations were used as powerful tools of learning in training institutions. According to Jones [5], these games and simulations were about the participant's experience of life with the indirect involvement of personal emotion (experiential learning).

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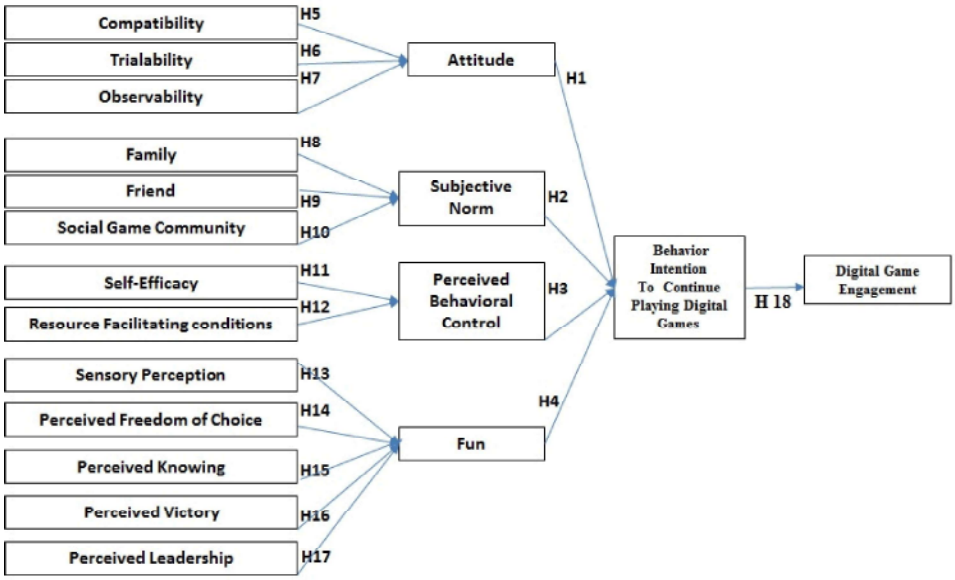

Fig. 1: The research model

Digital game acceptance relates to a circumstance during which a digital gamer encounters a new digital game for the first time and decides from his/her intention beliefs to play (in a positive sense) or not to play (in a negative sense). Digital game engagement (actual continue playing digital games) is a circumstance during which a digital gamer has experienced playing a digital game and decides from his/her intention beliefs to continue playing (in a positive sense) or not to continue playing (in a negative sense). This study identifies the dominant attributes of intention beliefs to continue playing digital games, associated with a broad spectrum of digital gamers (early gamers, casual gamers and hardcore gamers).

As fun has been introduced as one of the important constructs, it is essential to carry out a comprehensive study that has contributed to the understanding of fun belief factors in affecting the behavior of digital gamers and decompose fun into its constituent attributes. Since digital games is a technology that is purely for entertainment, fun has been included as a construct together with the constructs of attitude, subjective norms and perceived behavioral control to theoretically enhance the decomposed theory planned behavior model (DTPB) in the field of digital games adoption. In order to increase DTPB explanatory power, the factors (attitudes, subjective norm, perceive behavior control and fun) are further decomposed to attributes (salient factors). This extended DTPB quantitatively determines the antecedent variables which contribute to the intention to continue playing digital games specifically for Malaysian digital games culture and environment. Figure 1 shows the research model of the study.

Methodology: The outlines specific investigative plan for the study are presented in Figure 2. Research design, sampling frame, research methods, instrument development, pilot test, the administration of the actual survey, data collection and analysis procedures are discussed.

Research Design: Research design incorporates methods and procedures which became the main guide for this study from start to finish. The study consists of (a) literature review and the search for a valid digital games acceptance and engagement model, (b) development and validation of questionnaires which are the basis for the research instrument(c) multivariate constructs SEM data analysis procedures using SmartPLS and (d) finding, discussions and thesis writing.

Literature review was necessary to find research problems, identify research questions and recognize research objectives in order to ascertain a valid digital games acceptance and engagement model and variables. The development and validation of the research instrument include the identification of target audience (research subjects sampling), design and writing up processes to come up with the questionnaires and pilot survey.

Structural Equation Modeling (SEM) data analysis using SmartPLS computational tool was used to validate measurements and structural model used in this study.

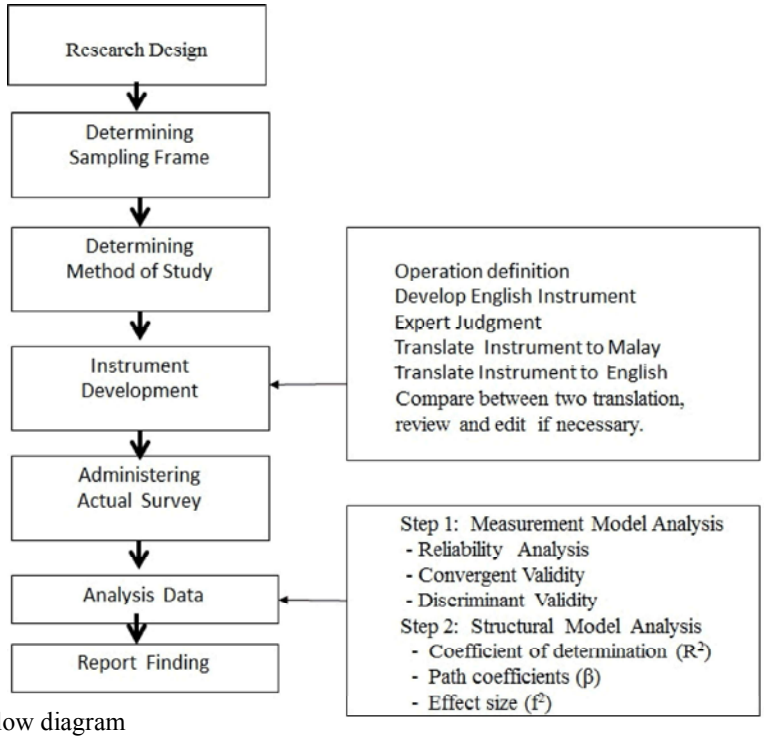

Fig. 2: Methodology flow diagram

Detail description of the quantitative approach used for the study relating to frame sampling, survey administration, sample size, research instrument development and validation, procedures of data analysis and report writing are discussed in detail in the following sections.

Determining Method of Study: Quantitative approach using survey method is considered to be the most appropriate technique to cater for a pre-determined compilation of abstract information such as beliefs or perception. Using survey approach, it is possible to get responses from subjects who are dispersed geographically throughout Malaysia [6-7]. The most popular method of measuring acceptance beliefs, is via descriptive analytical quantitative surveys [3].

Instrument Development: The instrument was conceived in three stages, starting from instrument design (design of the questionnaires), followed by items instrument development (the process of writing up and translation by the experts) and subsequently instrument validation (validation of the content of the questionnaires).

Design Questionnaire (Instrument): The goal of research instrument and the suitability of target respondents in the sampling process were important issues. The development of operational definition for attributes and constructs were based on what had been most commonly used in previous studies. It was also based on preliminary surveys and views from digital game experts [8].

As this study was concerned with the acceptance and engagement of digital games, it was necessary to look into not only from the perspective of digital gamers (users) but also from the perspective of digital games designers. Ideally, the perspective of digital gamers and that of digital games designers should match when it came to intention beliefs influenced by the entire constructs, especially fun. For this reason, opinions of experts and successful digital game designers such as Shigeru Miyamoto (Mario Games), Will Wright (Games Sim City), Sid Meier (Flying Combat games), Richard Garfield (Card games) and Gary Gygax (RPG World of Warcraft) were solicited through secondary data [9].

The items in the questionnaires for research instrument development was based on the results of preliminary surveys and the results of previous investigative studies on technology acceptance [10-21]. The results of previous investigative studies would provide items (questionnaires) for existing constructs such as attitude, subjective norm, perceived behavioral control and fun.

Table 1: Questionnaire (items of each construct)

No.	Modified and Refined Items for the Study
1	I think playing my favorite digital games is compatible with my lifestyle.
2	I think playing my favorite digital games is compatible with the way I like to engage with playful activities.
3	I think playing my favorite digital games fits with my playful activities preferences.
4	I think playing my favorite digital games fit well with all aspects of my playful activities.
5	Before deciding on whether or not to play my favorite digital games, I want to be able to properly try it out.
6	Before deciding on whether or not to play my favorite digital games, I want to be able to play it on a trial basis.
7	Before deciding on whether or not to play my favorite digital games, I want to experiment with it as necessary.
8	Before deciding on whether or not to play my favorite digital games, I want my favorite digital games to be available to me to adequately test run it.
9	My favorite digital game has attracted attention of gamers.
10	My favorite digital games is widely observed to be played by digital gamers
11	My favorite digital games are visible to digital gamers.
12	My favorite digital games can be easily seen on digital gamers' devices (such as PC or Mobile).
13	I play my favorite digital games because my family also play it.
14	I play my favorite digital games because my family influence me to play it.
15	I have to play my favorite digital games because my family think I should play it.
16	I will have to play my favorite digital games if my family has already play it.
17	I play my favorite digital games because my friends also play it.
18	I play my favorite digital games because my friends influence me to play it.
19	I have to play my favorite digital games because my friends think I should play it.
20	I will have to play my favorite digital games if my friends have already play it.
21	I play my favorite digital games because my social game community play it.
22	I play my favorite digital games because my social game community influence me to play it.
23	I have to play my favorite digital games because my social game community think I should play it.
24	I will have to play my favorite digital games if my social game community have already play it.
25	I am confident of playing my favorite digital games even if there is no one around to show me how to play it.
26	I am confident of playing my favorite digital games even if I have never played it before
27	I am confident of playing my favorite digital games if I have just seen someone playing it
28	I have the capability to play my favorite digital games.
29	The resources needed to play my favorite digital games are available to me
30	I could easily get access to the resources that are needed to play my favorite digital games.
31	I have enough hardware, software and services needed to play my favorite digital games
32	I have sufficient resources to play my favorite digital games
33	I feel that my favorite digital games have a good visual effect
34	I feel that my favorite digital games have a good sound effect.
35	I feel that my favorite digital games provide me with good sense of control with the touch of input and output interactive devices
36	I feel that my favorite digital games provide me with the sense of warm feelings
37	I feel that my favorite digital games allow me to determine selection's path in my gameplay.
38	I feel free to choose what and how many things to do simultaneously in my favorite digital games.
39	I feel that my favorite digital games provide me a lot of alternatives to choose
40	I feel that my favorite digital game allows me to choose gameplay's characters and their behaviors.
41	I feel that my favorite digital game allow me to choose actions that can transform the gameplay environment.
42	I feel that my favorite digital games provide me a sense of ability to understand the knowledge about tools to solve a problem in gameplay.
43	I feel that my favorite digital games provide me a sense of ability to understand difficulty and complicated idea to solve problems quicker in gameplay.
44	I feel that my favorite digital games provide me a sense of ability to understand a situation well to undertake new mission continuously in gameplay.
45	I feel that my favorite digital games provide me a sense of ability to understand thing clearly about new ideas and ways of solving problem in gameplay.
46	I feel that my favorite digital games give me a sense of success to overcome challenge at the margin of my ability to complete the task
47	I feel that playing my favorite digital games give me a sense of achievement to overcome obstacles through patience and commitment that enable me to continue surviving in gameplay.
48	I feel that my favorite digital games give me a sense of winning in overcome hurdles achieving a goal in game play
49	I feel that my favorite digital games give me a sense of pride to overcome multi-tasking's challenge in managing a lot of things at once
50	I feel that my favorite digital games give me a sense of position being in charge in gameplay
51	I feel that my favorite digital games give me a sense of position being in power to make decision in gameplay
52	I feel that my favorite digital games give me a sense of position being in responsible in managing characters in gameplay.
53	I feel that my favorite digital games give me a sense of position being as guidance in carry out missions in gameplay.
54	I think that playing my favorite digital games is a good idea
55	I think that paying my favorite digital games is an appealing idea
56	I like the idea of playing my favorite digital games
57	I think that playing my favorite digital games is a beneficial idea
58	People who influence my behavior thinks that I should play my favorite digital games

Table 1: Continued

No.	Modified and Refined Items for the Study
59	People who are important to me thinks that I should playing my favorite digital games
60	People whose opinions I value think I should play my favorite digital games
61	People whose opinions I honor think I should play my favorite digital games.
62	I was able to play my favorite digital games well
63	Playing my favorite digital games is entirely within my control
64	I have the knowledge to play my favorite digital games
65	I would be able to play my favorite digital games because I have the capability in term of skills to play it.
66	I would be able to play my favorite digital games because I have the capability in term of resources to play it.
67	I enjoy playing my favorite digital games
68	I feel excited playing my favorite digital games
69	I feel a lot of pleasure playing my favorite digital games.
70	I feel happy when playing my favorite digital games
71	I intend to continue playing my favorite digital games in future
72	It is likely that I will continue playing my favorite digital games in future
73	If given the chance, I predict I will continue playing my favorite digital games in the future.
74	I expect to continue playing my favorite digital games in future.
75	On average, I play my favorite digital games _____ hours per week.

Table 2: The original source ofquestionnaires

Construct/ attributes	Original Source	No
Compatibility	[10][13-14]	1-4
Trialability	[6-7][14][22]	5-8
Observalability	[13][22]	9-12
Family	[10][23]	13-16
Friend	[6-7]	17-20
Social Game Community	[24-25]	21-24
Self-Efficacy	[10][26]	25-28
Resource facilitating condition	[10][26-27]	29-32
Sensory Perception	[28]	33-36
Perceived Freedom of Choice	[29-31]	37-41
Perceived Knowing	[32-34]	42-45
Perceived Victory	[33]	46-49
Perceived Leadership	[32][35]	50-53
Attitude	[10-11] 26]	54-57
Subjective Norm	[10-11][26]	58-61
Perceived Behavioral Control	[10-11][26]	62-66
Fun	[26]	67-70
Intention To Continue	[11][26]	71-74
Engagement (Actual Behavior)	[36]	75

A paper-based questionnaire was used as the instrument for the survey and it was in English and Malay. All items used to measure the variables in this study were adopted from previous validated instruments. Table 2 shows the constructs and the original source of the questionnaires.

Translation Process: The respondents for the study came from multi-racial groups with varied educational background and with different abilities in the used of the English language or the Malay language. Hence, it was necessary to provide questionnaires in both languages. All respondents were able to understand the questions asked when they were allowed to refer to these two language versions.

Hence, it was important that the English language version of the questions asked to be identical in its meaning to the Malay language version. To make this possible, the translation procedure had to follow the process steps, namely:

- Validated instrument in English for digital games acceptance model was developed by the researcher.
- translator from academia who was considered expert in digital games and who was good in English language as well as in Malay language was chosen by the researcher to translate the validated instrument in English into Malay language. This translation was checked by the researcher for grammatical errors and for any ambiguity.
- Another academia who was also an expert in digital games and who was good in English language as well as in Malay language was chosen by the researcher to work on simplifying the Malay version within the framework of the English questionnaire. The result of this simplification work was check by the researcher for any irrelevance in the Malay version.
- A third person from academia who also an expert in digital games and who was also was good in English language as welasinMlay language was chosen by the researcher to check and to ensure that the Malay translation didi not deviate in meaning from the original English version. This was carried out by re-traslating the Malay version into an English version and comparing the original English version to the re-taranslated English version. The researcher performed a rigorous check to ensure that these two versions were similar in meaning.

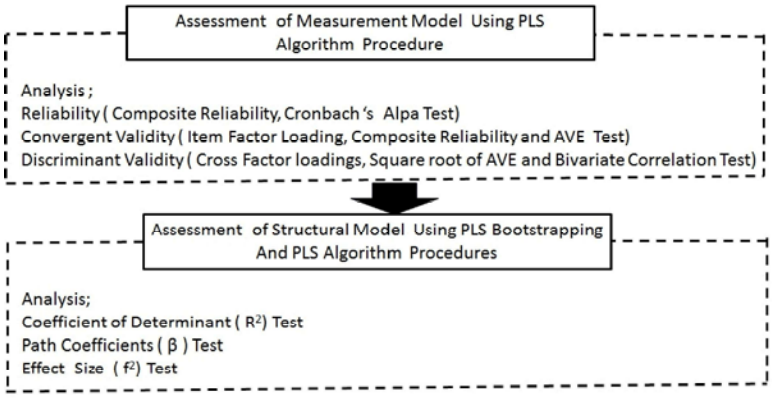

Fig. 4: Two-step SEM PLS path model assessment.

Determine Sampling Frame and Data Collection: The term "sampling" is used to denote the process of obtaining information from a sector of population. Therefore, during the steps of designing a sample, it was important to be mindful of two significant issues which were (a) the required sample size and (b) how individuals were chosen for survey participation and administration.

The determination of the appropriateness of sample size is a very important aspect in any research. Kelloway [37] and Hair *et al*. [38] suggested a sample size of at least 200 observations. Benter and Chou [39] stated that the ratio of respondent to variable be between 5:1 and 10:1.

In this study, 20 respondents per variable was used. This respondents to variable ratio (RVR) had exceeded the value which had been recommended by researchers such as Kelloway [37], Hair anderson, Tatham and Black [38], Benter and Chou [39]. There were 19 variables in this study. With 20 respondents per variable, the sample size computed would be 19 x 20 = 380. This means that a sample size of 400 had exceeded the RVR and using SmartPLS theory-based model would yield a reliability of more than 0.95. Hence, this research would require minimum sample sizes of 380.

The Sample and Administering the Survey: Participation in the survey was voluntary. Subjects for this study were digital gamers in Malaysia, ages between 15 to 55 years old. This age group was chosen because ESA [40] had confirmed that in 2014, over 90% of digital gamers worldwide were in the age group of 15 to 55 years old with an average age of 35. Digital gamers within this age group had the maturity to express their opinion and perception freely without due influence from parents or guardians.

Purposive sampling and snowball technique [41-42] was used to recruit the respondents. This technique was necessary because digital gamers had a network of their own. Outwardly, it was difficult to distinguish a digital gamer from a non-digital gamer. Only a digital gamer could identify someone was of his/her kind. For this reason, purposive sampling facilitated better judgment as who could provide the best information to accomplish the objective of the study. Snowball sampling uses networking to pick out a sample.

Data Analysis Procedures: Data analysis was carried out using the two-step SEM PLS path model assessment shown in Figure 4. The first step assessed the measurement model using PLS algorithm while the second step assessed the structural model using PLS Bootstrapping. Measurement model assessment used (a) Cronbach' alpha and composite reliability tests to check for reliability (b) Item factor loading, composite reliability and AVE tests to check for convergent validity and (c) Cross factor loading, square root of AVE and bivariate correlation tests to check for discriminant validity.

While structural model assessment used (a) Coefficient of determinant R^2 test to indicate what proportion of the variance of dependent variable that can be explained by the independent variables, (b) Path coefficients â test to check the relationship strength between the latent variables of the research model and (c) Effect size f^2 test to check how substantial is the influence of independent variable on dependent variable.

Pilot Test: Pilot test was conducted by obtaining responses from cybercafés at the vicinity of UTM, Skudai, Johor. A rule of thumb which stipulates that the sample size of the pilot study group should range from 25 or 50 respondents. Altogether 85 complete responses were received. Although pilot test would not require 85 respondents, these 85 responses were used in the pilot test because they were already available. The purpose of

the pilot test was to solicit comments and to obtain suggestions and feedbacks on the instrument from respondents. It was also used to estimate the length of time required to answer the set of questions.

The items were designed based on the quality and not on the quantity so that respondents would be able to understand the questions clearly and to be able to answer these questions correctly. These items were also designed such that they were reasonably brief and arranged in an interesting sequence to avoid boredom which could affect the validity of the data. The length of the questionnaires was designed such that it would take respondents less than 30 minutes to answer them.

RESULTS

The reliability coefficient (Cronbah's alpha) was computed for the 85 responses obtained. According to Cronbach, the questionnaires for a construct are considered reliable if the reliability coefficient (Cronbah's alpha) > 0.7. Table 3 shows the reliability coefficients (Cronbah's alpha) for all the constructs used for the pilot test for this study.

Results of the study show that all constructs exhibited the value of composite reliability, ranging from 0.904 to 0.946, all of which are greater than the acceptable level of 0.7.

All the items (indicators) were loaded above 0.8 except item code OBSR4 under the attributes of observalability for which the loading value is 0.772.

Table 3: Result of Cronbach's alpha (Pilot Test)

Construct (Code)	No of items	Pilot test
Cronbach Alpha		
Intention To Continue (Int_C)	4	0.91
Attitude (Att)	4	0.90
Subjective Norm (SN)	4	0.92
Perceived Behavior Control (PBC)	5	0.90
Fun (Fun)	4	0.90
Compatibility (A_Com)	4	0.89
Trialability (A_ Tri)	4	0.87
Observability (A_OBS)	4	0.87
Family (S_FAM)	4	0.94
Friend (S_FRIE)	4	0.87
Social Game Community (S_SGC)	4	0.91
Self-Efficacy (P_SE)	4	0.87
Resource Facilitating Cond. ((P_RFC)	4	0.89
Sensory Perception (F_SP)	4	0.89
Freedom of Choice (F_PFC)	5	0.90
Perceived Knowing (F_PK)	4	0.88
Perceived Victory (F_PV)	4	0.88
Perceived Leadership (F_PL)	4	0.89

The average variance extracted (AVE) statistic is the third criteria used to assess the convergent validity. AVE for all the attributes and all the constructs in this study have values which range from 0.702 to 0.958, exceeding the threshold value of 0.5. The values on the diagonal of the square root of AVE and correlations among construct are greater than the off diagonal values.

DISCUSSION

Cronbach's alpha coefficient and composite reliability are examined to ensure the measures are reliable [43]. Cronbach Alpha provides an estimate for the reliability based on the indicator of intercorrelations for internal consistency. An internal consistency reliability value of above 0.7 is regarded as satisfactory [44]. In this study, the result of cronbachalpa coefficients for all constructs ranged from 0.88 to 0.94, well above the acceptable value of 0.7 for confirmatory research.

All constructs exhibited the value of composite reliability, ranging from 0.904 to 0.946, all of which are greater than the acceptable level of 0.7. This indicates that the measurement errors have been relatively small [45-46]. The measurements were first validated using SmartPLS SEM confirmatory factor analysis (factor loadings). The results indicated that all items were loaded above the acceptable threshold of 0.70, an indication of convergent validity [47](Fornell & Larcker (1981).

The average variance extracted (AVE) statistic is the third criteria used to assess the convergent validity. An AVE value of at least 0.5 indicates sufficient convergent validity [44-45]. AVE for all the attributes and all the constructs in this study have values which range from 0.702 to 0.958, exceeding the threshold value of 0.5. Hence, latent variables are able to explain more than half of the variance of its indicators on average.

Limitations of the Study: This study lacks focus by using a wide range of ages (between 15 to 55 years old) of respondents as subjects (digital gamers in Malaysia). Malaysians in the age group 15 to 55 years old have different life principles and interests. In particular, those in the age group between 15 to 19 years old who are still in school and who live with their parents, are open to the influence of their parents and members of their families. This is confirmed by ESA [40] which stipulated that more than 85% of this age group are greatly influenced by their parents in choosing and purchasing the genre and platform types of the digital games.

CONCLUSION

The research has indentified constructs that form the intentional behaviour for a digital gamer to continue and be engaged in digital games play. Previous studies have suggested that fun or perceived enjoyment could be one of the attributes that influence individuals to continue and engage in digital games. However, till now, the variable of fun or perceived enjoyment has been constructed as a single unified dimension and the current definition is inadequate to encapsulate digital gamer's intention to continue playing digital games.

Therefore, there is a need to further investigate the antecedent variables of fun rather than assuming it as a single unified dimension.

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