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Antecedents of the Adoption of Online Games Technologies:

The Study of Adolescent Behavior in Playing Online Games

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Abstract—This study has a purpose to investigate the adoption of online games technologies among adolescents and their behavior in playing online games. The findings showed that half of them had experience ten months or less in playing online games with ten hours or less for each time playing per week. Nearly fifty-four percent played up to five times each week where sixty-six percent played two hours or less. Behavioral Intention has significant correlation to model variables naming Perceived Enjoyment, Flow Experience, Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions; Experience; and the number and duration of game sessions. The last, Performance Expectancy and Facilitating Condition had a positive, medium, and statistically direct effect on Behavioral Intention. Four other variables Perceived Enjoyment, Flow Experience, Effort Expectancy, and Social Influence had positive or negative, medium or small, and statistically direct effect on Behavioral Intention. Additionally, Flow Experience and Social Influence have no significant different between the mean value for male and female. Other variables have significant different regard to gender, where mean value of male was significantly greater than female except for Age. Practical implications of this study are relevant to groups who have interest to enhance or to decrease the adoption of online games technologies. Those to enhance the adoption of online games technologies must: preserve Performance Expectancy and Facilitating Conditions; enhance Flow Experience, Perceived Enjoyment, Effort Expectancy, and Social Influence; and engage the adolescent's online games behavior, specifically supporting them in longer playing games and in enhancing their experience. The opposite actions to these proposed can be considered to decrease the adoption.

Keywords—adoption technology; online game behavior; adolescent

I. INTRODUCTION

Online games are multiplayer games that can be played in computers and mobile devices and can enable users to fantasize and be entertained, experience-oriented. Online games are categorized as entertainment-oriented and Internet-based information technology [1] and the most players of online games are adolescents. They are differed from children and adult in their physic, cognitive, emotional, and social life that grow rapidly. Poole & Peyton [2] divide adolescents into two distinctive periods that are early (10-14) and late (15-19) adolescent. Capabilities and needs of them are differed from children and adult.

Reference [3] conducted study on difference motivation of online game player and mentioned that playing games are a sociable activity, a spent of time, a helping to develop useful skills, an interesting, a worthwhile activity, an enjoyable activity, a lonely activity, a valuable activity, and excitement.

This study is a development from the main research [4] by the author. The main research investigated the adoption of online games technologies in Indonesia and used the respondents in high school, college, and master degree in the age range of 12-26. In this study, the respondents are adolescent and adult. Because of the interesting findings of the main research, the author needs to conduct a new study in factors influencing the adoption of online game technology among adolescents and their behavior in playing online game using a part of data in the age range of 12-17 years and the model developed by the main research.

Many factors influenced on behavioral intention to play online games in adoption of online game technology from previous related studies. The main factors came from information technology, psychology, and economy science including performance expectancy, effort expectancy, social influence, facilitating condition, and the hedonic motivation: perceived enjoyment and flow experience. The two last factors are the interesting factors for adoption of online games technology research because online games are technology for entertainment purpose. This study has a purpose to examine the antecedents of the adoption of online games technologies among adolescents through investigating behavioral intention to play online game. Through collecting data, such as the profile of respondent and analyzing the variables that affect the adoption of online games technologies, the prediction of human factors that affect an individual's intention to adopt online gaming technologies can be reached and the adolescent behavior in playing online games can be investigated. To achieve these goals, the study address two research questions, "How is adolescent behavior in playing online games?" and "What factors are influencing the adoption of online game technologies among adolescents".

II. PREVIOUS STUDIES AND HYPOTHESES

This study uses theoretical model developed by [4] to examine factors predicted to be antecedents of the adoption technology of online games among adolescents. The model was developed by extending the Unified Theory of

Acceptance and Use of Technology (UTAUT) model by [5], with two variables Perceived Enjoyment and Flow Experience which are searched from previous studies of online games.

The related previous studies of online games employed the Technology Adoption Model (TAM) by [6], the Theory of Planned Behavior (TPB) by [7], Combining-TAM-TPB, and UTAUT model to examine the antecedent of the adoption technology of online games among online game players. Through the investigation of the previous studies, two variables Perceived Enjoyment and Flow Experience which have a strong impact on behavioral intention to play online games were added to the UTAUT model to propose new model. This study adopted theoretical model from the main research [4] that employs six hypotheses as shown in Table I. Fig. 1 shows the theoretical model used in the study.

TABLE I. RESEARCH HYPOTHESES

No.	Hypothesis
H1:	Perceived Enjoyment has a significant direct effect on Behavioral Intention.
H2:	Flow Experience has a significant direct effect on Behavioral Intention.
H3:	Performance Expectancy has a significant direct effect on Behavioral Intention.
H4:	Effort Expectancy has a significant direct effect on Behavioral Intention.
H5:	Social Influence has a significant direct effect on Behavioral Intention.
H6:	Facilitating Conditions has a significant direct effect on Behavioral Intention.

Behavioral intention was the dependent variable in most of studies of adoption technology. Reference [1] defined Behavioral intention as the extent to which the user intends to play online games in the future. Flow experience was defined as the holistic experience that people feel when they act with total involvement [1], [8], [9]. Meanwhile, Perceived Enjoyment was defined as the extent to which an individual perceives that playing online games is enjoyable [10].

In the previous studies of online gaming, Flow Experience and Perceived Enjoyment were two variables that had significant relation to Behavioral intentions as in [1], [8], [9], [10], [11], [12], [13], and [14]. The other study on adoption technology as in [15] had the same result about these relations.

Performance Expectancy was defined as the degree to which an individual believes that using the system will help them to attain personal gains [5]. Reference [5] also defined Effort Expectancy as the degree of ease associated with the use of the system.

The variables, Perceived Usefulness (Performance Expectancy) and Perceived Ease of Use (Effort Expectancy) had direct effect on Attitude as stated in [6]. The studies conducted by [1] and [8] tried to link Perceived Usefulness to behavioral intention where the direct effect was not significant. When Attitude was removed from the model as stated in [9], Perceived Usefulness and Perceived Ease of Use had direct effect on Behavioral Intention. Otherwise, Attitude had strong effect on Behavioral Intention while Perceived

Usefulness and Perceived Ease of Use was removed from the model. These findings were in accordance with Venkatesh [5] that proposed UTAUT model without attitude. Attitude had been covered by Performance Expectancy and Effort Expectancy.

Reference [5] defined Social Influence and Facilitating Conditions as the degree to which an individual perceives that other important people believe that they should use the system and the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system respectively.

Social influence had strong relation to user's intention to play online games as in [1], [8], [9], and [10]. Facilitating conditions also had direct relation on user's intention to play online games as in [8].

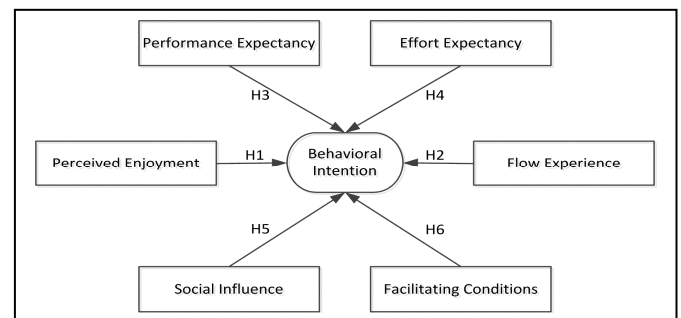


Fig. 1. Theoretical Model

III. METHOD

The study analyzed 366 respondents in age range of 12-17 years out of 895 in the main research [4] that had passed the testing by a pilot study and some errors filtering. From 366 data, seven (7) data were removed from the sample because of out-of-range values in education variables. Consequently, the final sample size was 359 and it sufficiently satisfied the minimum sample size as in [16].

The data was analyzed with SPSS software to get profile and characteristics of respondents and with SEM Amos to examine the theoretical model and to get antecedents of adoption of online games technologies. The profile and characteristics that figured behavior of adolescents in this study were the practice and experience in playing online games.

IV. DATA ANALYSIS

A. Descriptive Data Analysis

The analysis of the data from the response of questions in the questionnaire was designed to produce: a profile of the respondents; the type of games, the technologies used, and the location; the number and duration of game sessions; the frequency and experience in playing online games; and the correlation among the profile of respondent variables and variables in theoretical model. This analysis is expected to reveal the behavior of adolescents in playing online games.

Profile of respondents regarding to age, education level, and gender are shown in Table II, III, and IV respectively. Most of them are female (61 percent), currently enrolled at senior high school (66 percent), and in the age of 17 years (40 percent).

TABLE II. AGE DISTRIBUTION OF RESPONDENTS

Age (Years)	Frequency	Percent
12	28	7.8
13	56	15.6
14	37	10.3
15	43	12.0
16	63	17.5
17	132	36.8
Total	359	100.0

TABLE III. EDUCATION LEVEL OF RESPONDENTS

Education Level	Frequency	Percent
Junior High School	121	33.7
Senior High School	238	66.3
Total	359	100.0

TABLE IV. GENDER OF RESPONDENTS

Gender	Frequency	Percent
Male	141	39.3
Female	218	60.7
Total	359	100.0

The technologies used, location, and types of game in playing games are shown in Table V, VI, and VII respectively. Most of respondents used mobile phone/tablet (67 percent) in playing online games; they were more comfortable in home/friend home (91 percent) when playing online games; and they were more often playing alone (46 percent). It is seen on Table VIII, Line Get Rich and Clash of Clans were the most popular recently played online games played by 60 and 59 participants respectively.

TABLE V. TECHNOLOGIES USED FOR PLAYING ONLINE GAMES

Technology Used	Frequency	Percent
Desktop PC	43	12.0
Laptop/notebook	75	20.9
Mobile phones/tablets	241	67.1
Total	359	100.0

TABLE VI. LOCATION FOR PLAYING ONLINE GAMES

Location	Frequency	Percent
Home/friends home	327	91.1
School	7	1.9
Net Cafe/game center	25	7.0
Total	359	100.0

TABLE VII. TYPES OF GAME FOR PLAYING ONLINE GAMES

Type of Game	Frequency	Percent
Single player	164	45.7
Multi players	123	34.3
Massively Multi players	72	20.1
Total	359	100.0

TABLE VIII. POPULAR GAMES FOR PLAYING ONLINE GAMES

Popular Games *	Frequency
Get Rich	60
Clash of Clans	57
Counter Strike	20
Duel Otak	17
DotA	16
Hay Day	12
Point Blank	12

* Popular games were defined as those that were identified by at least 10 participants as a game that they had played recently.

The behavior regarding to the number and duration of game sessions are shown in Table IX and X respectively. In Table IX, half of respondents (54 percent) played up to 5 times each week and almost one-third (30 percent) played 10 or more times per week. In Table X, two hours or less were most playing sessions (66 percent) and the extreme session for playing (5 hours or more) was done by 11 percent.

TABLE IX. NUMBER OF GAME SESSIONS

Number of Times Games Are Played Each Week	Frequency	Percent	Cumulative Percent
1 time	39	10.9	10.9
2 times	46	12.8	23.7
3 times	39	10.9	34.5
4 times	37	10.3	44.8
5 times	33	9.2	54.0
6 times	8	2.2	56.3
7 times	38	10.6	66.9
8 times	9	2.5	69.4
9 times	1	.3	69.6
10 or more times	109	30.4	100.0
Total	359	100.0	

TABLE X. DURATION OF GAME SESSIONS

Number of Hours Each Time Games Are Played	Frequency	Percent	Cumulative Percent
Less than 1 hour	88	24.5	24.5
1 – 2 hours	150	41.8	66.3
3 – 4 hours	81	22.6	88.9
5 hours or more	40	11.1	100.0
Total	359	100.0	

The number of hours spent playing games each week and the months of experience in playing games are shown in Tables XI and XII respectively. In Table XI, half of the respondents (54 percent) played for 10 hours or less per week. One-quarter (27 percent) played for 6 to 10 hours per week and the other 27 percent played 1 to 5 hours per week. In Table XII, half of respondents (50 percent) experienced 10 months or less and 40 percent experienced 17 months or more.

The differences between the mean values of variables for males and females are shown in Table XIII. It is seen that for two variables Flow Experience and Social influence, there were no significant difference between the mean value for males and females ($p < 0.05$). The other variables show that there were significant difference between them with the mean for males was significantly greater than the mean for females

except for Age. For Age, the mean for males was significantly lower than the mean for females.

(H/W). All of the profile variables also have significant correlation ($p < 0.05$) to Age (A) and Experience (E).

TABLE XI. FREQUENCY OF GAME PLAYING

Number of Hours per Week Playing Games	Frequency	Percent	Cumulative Percent
1-5	95	26.5	26.5
6-10	98	27.2	53.8
11-15	28	7.8	61.6
16-20	57	15.8	77.4
21-25	7	1.9	79.4
26-30	12	3.3	82.7
31-35	4	1.1	83.8
36-40	31	8.7	92.5
41-45	5	1.4	93.9
46-50	1	.3	94.2
51-55	0	0	94.2
56-60	21	5.8	100.0
Total	359	100.0	

TABLE XII. EXPERIENCE OF GAME PLAYING

Months of Experience in Playing Games	Frequency	Percent	Cumulative Percent
Less than or equal to 1 month	56	15.6	15.6
2-4 months	64	17.8	33.4
5-7 months	42	11.7	45.1
8-10 months	17	4.7	49.9
11-13 months	25	7.0	56.8
14-16 months	11	3.1	59.9
17 months or more	144	40.1	100.0
Total	359	100.0	

Table XIV presents the correlations among profile variables, among model variables, and between profile variables and model variables. Furthermore, among dependent variable Behavioral Intention to other variables does the statistically significant correlation ($p < 0.05$) as described by [17].

From the Table XIV, it is seen there are significant correlation ($p < 0.05$) among the profile variables naming Education Level (EDU), Number of Times Games Are Played Each Week (T), Number of Hour Each Time Games Are Played (H), and Number of Hour per Week Playing Games

TABLE XIII. DIFFERENCES BETWEEN MALES AND FEMALES

Variable	Levene's Test for Equality of Variances		t	Statistical Significance (2-tailed)	Mean (Males) - Mean (Females)
	F	Statistical Significance			
Age	12.421	.000	-4.713	.000	-.887
Experience	4.904	.027	6.180	.000	4.413
Number of Times Games Are Played Each Week	.571	.450	4.542	.000	1.605
Number of Hours Each Time Games Are Played	18.181	.000	6.213	.000	1.041
Number of Hours per Week Playing Games	13.097	.000	5.809	.000	9.877
Flow Experience	.138	.711	2.617	.009	.24084
Perceived Enjoyment	.005	.945	5.075	.000	.34407
Performance Expectancy	.248	.619	3.479	.001	.30816
Effort Expectancy	.393	.531	4.992	.000	.36999
Social Influence	.117	.732	.971	.332	.06516
Facilitating Conditions	.189	.664	5.587	.000	.40193
Behavioral Intention	12.011	.001	4.357	.000	.30370

Notes: For Levene's test variances are assumed to be equal if and only if the statistical significance is 0.05 or greater.

The three of the profile variables T, H, and H/W have significant correlation ($p < 0.05$) to all model variables except to Social Influence (SI). EDU has significant correlation ($p < 0.05$) to all of model variables except to Flow Experience (FE), Social Influence and Behavioral Intention (BI). Age has significant correlation ($p < 0.05$) to all of model variables except to Social Influence and Behavioral Intention.

Experience has significant correlation ($p < 0.05$) to all of model variables except to Social influence and Flow Experience. The last, all of independent variables in the theoretical model and profile variables have significant positive correlation ($p < 0.05$) to dependent variable Behavioral Intention except to Education Level and Age.

TABLE XIV. CORRELATIONS AMONG VARIABLES

Variable	Profile Variable						Model Variable					
	EDU	T	H	H/W	A	E	FE	PCE	PE	EE	SI	FC
Education Level (EDU)	1											
Number of Times Games Are Played Each Week (T)	-0.143	1										
Number of Hours Each Time Games Are Played (H)	-0.146	.262	1									
Number of Hours per Week Playing Games (H/W)	-0.150	.701	.796	1								
Age (A)	.900	-.154	-.194	-.179	1							
Experience (E)	-.199	.321	.410	.427	-.206	1						
Flow Experience (FE)	-0.083	.180	.257	.226	-.105	.101	1					
Perceived Enjoyment (PCE)	-0.153	.308	.349	.365	-.179	.316	.291	1				
Performance Expectancy (PE)	-0.160	.228	.268	.280	-.162	.219	.094	.425	1			
Effort Expectancy (EE)	-0.231	.262	.276	.279	-.267	.256	.248	.457	.335	1		
Social Influence (SI)	.000	.000	.001	-.055	.036	-.018	.000	.099	.362	.096	1	
Facilitating Conditions (FC)	-0.159	.271	.358	.363	-.205	.392	.169	.475	.316	.456	.100	1
Behavioral Intention (BI)	-0.014	.264	.291	.328	-0.034	.246	.195	.421	.399	.287	.108	.422

Note: Correlation coefficients in bold type are statistically significant ($p < 0.05$).

TABLE XVI. INTERPRETATION OF MODEL FIT STATISTICS

Model Fit Statistics	Interpretations
Model Chi-Square χ^2	Small values of χ^2 with $p > 0.05$ indicate at least a reasonable fit.
χ^2/df (Normed Chi-square, NC) where df is the degrees of freedom	Values of $0 < NC < 5$ are considered to indicate at least a reasonable model fit.
RMR (Root Mean Square Residual)	RMR values close to 0 indicate a good model fit. The fit gets worse as the value of RMR increases.
GFI (Goodness of Fit Index) AGFI (Adjusted GFI)	GFI = 1 means a perfect fit, GFI > 0.9 means a good fit, GFI = 0 indicates a poor fit. AGFI corrects GFI downward based on model complexity
NFI (Normed Fit Index) IFI (Incremental Fit Index) CFI (Comparative Fit Index)	NFI, IFI, CFI should have values > 0.9 to indicate a good model fit.
RMSEA (Root Mean Square Error of Approximation)	RMSEA < 0.05 means a close fit; between 0.05 and 0.08 means a reasonable fit, 0.1 or more indicates a poor fit.

B. Statistically Model Analysis

The analysis of the model used AMOS software and the results of the SEM analysis are shown in Fig. 2. The results are the direct causal effect and it was presented in two formats. Firstly, the unstandardized effect and the statistical significance of the unstandardized effect in series using *, **, and *** to show statistical significance at a level of 0.05, 0.01, and 0.001, severally. Otherwise, NS was used to show no statistically significant at a level of 0.05 or less. Secondly, the number in parentheses present the standardized effect and an interpretation of the magnitude of its, the magnitude as described by [18] is Small (S) when it is less than 0.1 and Medium (M) while it is 0.1 to less than 0.5.

The result in Fig. 2 shows that Performance Expectancy and Facilitating Conditions had a positive, medium, and statistically direct effect on Behavioral Intention. The other variables naming Perceived Enjoyment, Flow Experience, Effort Expectancy, and Social Influence had a positive or negative, medium or small, and not statistically significant at a level of 0.05 or less.

It is clear that only hypotheses H3 and H6 are fully supported, meaning there were a statistically significant direct causal effect at a level of 0.05 or less between the two independent variables and Behavioral Intention in the result in Fig.2 and the two variables had also a statistically significant correlation ($p < 0.05$) as in the result in Table VI. The other hypotheses (H1, H2, H4, and H5) are partially supported, meaning there was a statistically significant correlation ($p < 0.05$) between the four independent variables and Behavioral Intention although the variables had no statistically significant direct causal effect at a level of 0.05 or less.

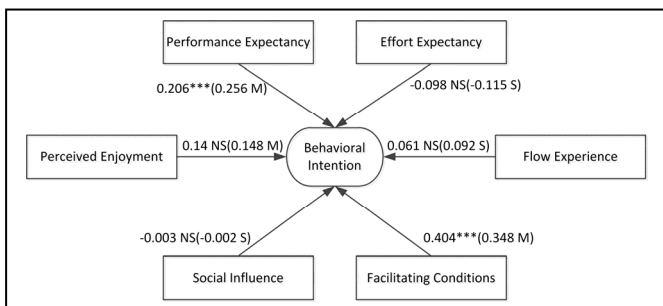


Fig. 2. The Result of Analysis of Theoretical Model

Table XVI is recommended by [17] to assess the fit of the theoretical model and their interpretations. From Table XV and XVI, the values of the fit statistics for analysis of the theoretical model and the results have very satisfactory fit statistics.

TABLE XV. FIT STATISTICS FOR THE THEORETICAL MODEL

Model	N	NC (χ^2/df)	RMR	GFI	AGFI	NFI	IFI	CFI	RMSEA
Theoretical Model	895	389.252/168 = 2.317	.042	.906	.871	.976	.899	.939	.061
R ² : BI (33 percent)									

Note: R² is the proportion of the variance of the variable Behavioral Intention that is explained by the variables affecting it.

V. FINDINGS AND DISCUSSION

A. Adolescent Behavior in Playing Online game

The analysis of data in this study shows that EDU and Age had sufficient negative correlation to Experience and a spent of time in playing online games (T, H, and H/W). It means that early adolescent in junior high school consumed more time and had more experience in playing online games than late adolescent in senior high school.

It is quite surprisingly that a spent of time in playing online games had significant positive correlation to all variables in theoretical model except to Social Influence. It means that the more time adolescent playing online games, the more they will: involve in gaming; find more enjoyable in gaming; have a stronger belief that using gaming systems will help them to attain personal gains; find easier to use the gaming systems; have a strong belief that there is organizational and technical infrastructure to support use of gaming systems; and have a stronger intention to use gaming systems in the future.

Comparing to late adolescent, the early one is: more experienced in gaming; more time consuming in playing game; more enjoyable in gaming; more enjoyable in gaming; stronger belief that using gaming systems will help them to attain personal gains; easier to use the gaming systems; and stronger belief that there is organizational and technical infrastructure to support the use of gaming systems.

Comparing to adolescent females, the males are: more experienced in gaming; more time consuming in playing game; more enjoyable in gaming; stronger belief that using gaming systems will help them to attain personal gains; easier to use the gaming systems; stronger belief that there is organizational and technical infrastructure to support the use of gaming systems; and stronger intention to use gaming systems in the future.

Online game users especially adolescent can draw the benefits from the results of the study. They can use the findings regarding to their behaviors in playing online games to better adjust their time for playing games, keep doing their study, and keep having social interaction with others.

B. *The antecedent of Adoption of Online Game Technology among Adolescent*

From the analysis of theoretical model, it is indicated that all of dependent variables have significant correlation to Behavioral Intention. The findings are accordance to the results of the previous studies, although not all of dependent variables have statistically direct effect to Behavioral Intention. From the descriptive data analysis, it is also indicated that Experience (E) and a spent of time of adolescent playing online games (T, H, and H/W) have significant correlation to Behavioral Intention.

C. *Implications and Future Research*

From theoretical perspective the research findings confirmed the previous studies in online games. The adolescent behavior in playing online games is not reported in previous studies and it reveals new findings in this study.

Practical implications of findings are relevant to government, parents, teachers, and groups of people who have interest on factors that influence the adolescent's intention to play online games and their behavior. The group who has interest to enhance adoption of online games technologies among adolescents must: preserve factors having strong influence to their intention, Performance Expectancy and Facilitating Conditions; enhance factors naming Flow Experience, Perceived Enjoyment, Effort Expectancy, and Social Influence; and engage the their behavior regard to play online games.

Regarding to differences behaviors in playing online games among adolescents, their intention to play online games may be enhanced to female and late adolescent. The adoption can also be enhanced through; supporting them in longer playing games and enhancing their experience. Decreasing their intention to play online games can be considered through the opposite actions to those proposed.

This study explores the adolescent's behavior regarding to play online games through examining factors which influences their intention in playing online games in the future. This study implies weak external validity regard to the first study of online games conducted in Indonesia. The repeating studies will be required to enhance the validity of the study.

The future research may expand other behavioral factors naming habit and hedonic motivation stated in UTAUT2 model by [19]. Social Influence and Flow Experience, weak factors in this study, may be investigated in further research to get comparable result with this study.

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