

Acceptance of Online Learning during the Covid-19 Pandemic: An Innovation Diffusion Perspective

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Abstract

The transformation from conventional learning to full scale online learning during the COVID-19 pandemic has created challenges for the academics in various fields of study, who have to gain understanding on both the internal and external factors that will enable the learners to have positive learning behaviors that will enable the learners to achieve the learning outcomes based on the objectives of the study program. This research, thus aimed to analyze the online learning acceptance and study the influence of personal factors of the students on the online learning during the COVID-19 pandemic. The sample consisted of 386 Thai undergraduate students. The findings showed that the online learning acceptance during the COVID-19 pandemic comprised three components. Male students tended to accept the perceived benefits at the higher level than that of female students; students in the Digital Technology for Business Program accepted the perceived benefits at the same level with that of students in the Digital Technology for Design Program. The first year and fourth year students tended to accept the perceived benefits at the higher level than those of students in other class year levels; the fourth year students tended to accept that online learning was less complicated than those of students in the other class year levels; and finally, the first year students tended to acknowledge that they had trialed with online learning at the higher level than those of students in the other class year levels.

Keywords: Online learning; COVID-19 pandemic; diffusion of innovation theory

Introduction

The pandemic of COVID-19 caused several educational institutes to remain temporarily closed, and face-to-face learning has temporarily discontinued. These will have negative impacts on educational activities, due to social distance is crucial at this stage (Dhawan, 2020). These are the reasons why online educational activities grown up, so that there would be no interruption to education. Many educational faculties have made efforts to organize the best online educational activities (Mukhtar, Javed, Arooj, and Sethi, 2020; Zalat, Hamed, and Bolbol, 2021). In Thailand during the COVID-19 pandemic, the universities have provided various models of online instructional management in order to solve the learning problems for the students and enable them to gain access to the online instruction with the use of communication technology via various online learning platforms through the channels of

the university, and various computer programs or applications such as Zoom, Google Meet, Hangouts, Microsoft Teams, and Google Classroom, and also through other channels of the university, such as Cyber classroom, VDO On-demand, and LMS. In addition, there is also the use of online social media as the channel of instruction, such as Facebook, Line, Instagram, Twitter, Clubhouse, Podcast, and YouTube (Inthason, 2020; Ingard and Ingard, 2021).

Learning in a New Normal way of life is the issue that has been mentioned immediately when the COVID-19 pandemic occurred. Social distancing is one of the measures that have been implemented in order to control the spread of COVID-19. As such, the instructional management process has been immediately adjusted from using the conventional face-to-face teaching method to using the online teaching method in order to allow the educational personnel to work from home by using application programs to assist in the instruction, such as Zoom, Meet, Hangout, MS-Team. Therefore, the online instruction is concretely implemented in this situation (Boonphak, 2020). The online instructional management was introduced for use in Thailand a few years ago but its implementation was rather not successful. The occurred pandemic serves as the accelerator for the concrete implementation of online instructional management. It can be empirically evident that online learning can take the role as the accelerator for creating proactive learning and promoting creative thinking. It is flexible and can become the good distributor of the body of knowledge between the instructor and the learners (Singh and Thurman, 2019; Marwa Mohamed Zalatid et al., 2020). In addition, many authors, such as Mukhtar et al. (2020) mention that the online instructional management is simple and cost-effective. This is especially true for learners who live in remote areas. Also, the UN and WHO consider that online learning is a useful tool for responding to educational needs. The various faculties have used a lot of creative strategies to cope with the above situation with the use of various software/applications such as Google Classroom, Zoom, and Microsoft Teams for online instructional management not only for enabling the learners to graduate, but also for communicating with them on a continuous basis. So, the virtual classroom has been initiated during the COVID-19 pandemic.

However, the transformation from conventional learning to full scale online learning has created challenges for the academics in various fields of study including science and technology, social sciences, and humanities, who have to gain understanding on both the supporting factors and mobilizing factors that will enable the learners to have positive learning behaviors which the academics believe that will enable the learners to achieve the learning outcomes based on the objectives of the study program. Based on the above discussion, the research team is interested in applying the diffusion of innovation theory to find out the answers that under the COVID-19 pandemic, to what extent the online instructional management enables the learners to accept it. As such, the obtained information will reflex the efficiency of operation of the study program and can be applied for adjustment of instructional management in the future to be more effective and efficient.

Literature review

Diffusion of innovation theory (DOI)

The diffusion of innovation theory (DOI), as proposed by Rogers (1960, cited in Chaveesuk and Vongjaturapat, 2012), mentions that the innovations to be accepted should have the following attributes: (1) relative advantage, (2) trialability, (3) compatibility, (4) observability, and (5) complexity. Furthermore, Rogers (2003) states in his article that the innovation decision making process comprises 5 steps: knowledge creation, persuasion, decision, implementation, and confirmation. In the knowledge creation step, the person

searches for information concerning the innovation in order to find out what is that innovation, how to use it, and what are its benefits. In the second step, which is persuasion, the person invites or persuades the others to use the innovation by helping them to have positive attitude toward that innovation by presenting to them the innovation so that they perceive its relative advantage, compatibility, complexity, trialability, and observability.

Regarding the relative advantage, Rogers (2003, p. 229) explains that relative advantage is the degree to which an innovation is seen as advantageous to a current practice which can be measured in terms of economics, society, convenience, and satisfaction. In addition, the elements of motivation, demand, and/or value of the innovation are still the elements that have received the high level of interest for measurement. Rogers (2003, p. 258) explains that trialability is the degree to which an innovation can be tried and experimented with by potential adopters. The more the innovation is experimented with, the sooner it will be implemented. Also, if that innovation has been diffused to be widely and thoroughly known, and if its benefits are to be accepted, the adopters must be allowed to experiment with it in order to know its effectiveness and efficiency; and if there are any problems, those problems can be solved immediately. All of these will be factors that enhance its acceptance leading to the widely uses of that innovation (Perkins, 2011).

Regarding the third factor namely compatibility, Rogers (2003, p. 240) explains that compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters. Meanwhile, Perkins (2011) states that the attribute of compatibility should have the scope of meaning that is consistent with the values, beliefs, previous concepts, and needs of the adopters. The next is observability, Rogers (2003, p. 258) explains that observability is the degree to which the results of an innovation are visible to others. If the people can clearly observe the outcomes of that innovation, its acceptance and usage will be increased. The last one is the complexity, Rogers (2003, p. 257) explains that complexity is the degree to which an innovation is perceived as relatively difficult to understand and use. As such, the complexity of innovation will vary adversely with its acceptance and usage, i.e. if complexity of the innovation increases, its acceptance will decrease; and if the system is friendly with the adopters and the adopters have been previously trained on the uses of computer devices, supporting system, and technical knowledge, then the adopters will be helped to accept the innovation at the higher level (Perkin, 2011).

Acceptance and attributes of innovations

Rogers (2003, p. 221) states that the importance of factors affecting the acceptance of innovations must be recognized by the administrators, because the five attributes of the innovations have impacts on the rate of acceptance of the innovations by 87 percent (Rogers, 1995). Table 1 below presents the conclusion of Rogers' explanation on the impacts of the five attributes of innovations on the level of innovation acceptance (Rogers, 2003, p. 229 – 266).

In addition to the above concepts and theories, the review of previous research studies concerning the acceptance of online learning by the research team reveals attribute issues both different and similar to those in the diffusion of innovation theory, such as the research conducted by Thongnousuk (2020) which found that the acceptance of the innovation of online English language learning was the perception of relative advantage, complexity, trialability, and observability of online learning, and the research conducted by Ingard and Ingard (2021) which found that the acceptance of online learning of Thai students comprised four attributes, i.e. perception of relative advantage, perception of trialability, perception of compatibility, and perception of observability of the online learning. Therefore, this research article is aimed at

applying the diffusion of innovation theory to explain the extent of acceptance of online learning during the COVID-19 pandemic of undergraduate students, and to find out whether or not the acceptance of online learning during the COVID-19 pandemic of the students has the same component attributes as the component attributes of the diffusion of innovation theory.

Table 1: *Five attributes of innovations having impacts on the degree of innovation acceptance based on the diffusion of innovation theory*

Innovation Components	Attributes	Acceptance
(1) Relative advantage	Degree to which an innovation is seen as advantageous to a current practice	Positive—more perception of relative advantage, more acceptance
(2) Trialability	Degree to which an innovation can be tried and experimented with by potential adopters	Positive—more flexibility in being experimented with, more acceptance
(3) Compatibility	Degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters	Positive—more perception of consistency, more acceptance
(4) Observability	Degree to which the results of an innovation are visible to others	Positive—more perception of innovation results, more acceptance
(5) Complexity	Degree to which an innovation is perceived as relatively difficult to understand and use	Negative—more perception of innovation complexity, less acceptance

Source: *Petruzzelli (2010)*

In addition to the above-mentioned concepts and theories, the review of previous research results concerning the acceptance of online learning by the research team reveals many personal background factors affecting the acceptance of online learning, i.e. gender (Nistor, 2013; Cuadrado-García, Ruiz-Molina, & Montoro-Pons, 2010; Elumalai, Sankar, John, Menon, Alqahtani, & Abumelha, 2020; Ghaleb et al., 2021), educational level (Elumalai, Sankar, John, Menon, Alqahtani, & Abumelha, 2020; Yu, 2021; Ghaleb et al., 2021), and study program (Ingard et al., 2020; Gopal et al., 2021). Therefore, this research article would like to clearly and empirically compare to find out whether or not the students with different personal background factors of gender, year of study, and study program differ significantly in their levels of acceptance of online learning based on attributes of acceptance.

Research Methodology

Population and Sample

This research was a quantitative research with the cross-sectional research design. The target population comprised bachelor's degree students in the Faculty of Information and Communication Technology of Silpakorn University. After having been certified as passing the ethical criteria of research on human being, the research team used an online questionnaire to collect data from the research sample consisting of 400 undergraduate students who had been randomly accessed via @ su.ac.th or @ silpakorn.edu e-mail systems. The sample size was calculated using the calculation formula for sample size with the confidential interval of 95 % and the accepted 0.05 alpha level for errors. The research sample was obtained by stratified random sampling proportionate to the population, with the study program being

designated as the stratification, and using the quota sampling to obtain 100 students for each class year level. All 400 sets of questionnaire were completed and returned within a week while the students were undertaking online learning during the COVID-19 pandemic. However, only 386 sets of questionnaire were found to be valid with complete answers. Analysis results of demographic characteristics of respondents showed that female students outstandingly cooperated in answering the questionnaire (67.60 %), a little more than half of the number of respondents were students in the Communication Arts Program (51.00 %), and the proportions of first year to fourth year students were almost similar (23.60 % - 25.90 %).

Instrument and Data Measurement

The online questionnaire used as the data collecting instrument for this research was a questionnaire that comprised a part containing questions on demographic or personal background factors of respondents, namely, gender, study program, and class year level. The questions in this part were multiple-choice items. The questions in the second part were those on acceptance of online learning with reference to the DOI theory that consisted of five attributes of innovations having impacts on the degree of innovation acceptance, i.e. relative advantage, compatibility, complexity, trialability, and observability. There were 25 items each of which was a question of 5-level rating scale ranging from 1 (least agreeable) to 5 (most agreeable). They were adapted from questionnaires in research studies conducted by Shiau et al. (2018); Lee et al. (2011); and Oh and Yoon (2014). The questionnaire was submitted for quality verification by three academics in the online learning management field of study. After being analyzed with the Index of Item-Objective Congruence (IOC), it was found that all items had the IOC means of higher than 0.50. After that, the questionnaire was pilot tried out with 30 students. The try-out results revealed that two items had wordings that needed to be revised to make them easier to understand. So, the research team revised the wordings of the two items accordingly.

The results reported in this part were still not the results of measurement of the five attributes based on the diffusion of innovation theory, but were the results of reliability testing of each attribute that would be applied in this research with the use of Cronbach's alpha coefficient to measure the internal consistency of each attribute under study; also, each attribute was supplementary analyzed to confirm its structure with KMO value and Bartlett test of sphericity χ^2 statistics. As such, in verification of the appropriateness of components, Hair et al. (2010) have proposed that KMO should be higher than .60, and the Bartlett test should be significant. The results of verification of the instrument in this research enabled the research team to be confident that the structure of each attribute based on the DOI theory was appropriate, as shown in Table 2 below:

Table 2: *Reliability and construct validity for DOI attributes of online learning acceptance during the COVID-19 pandemic*

Construct	Items	Cronbach's Alpha	KMO	Bartlett test	p-value
Relative advantage	5	.914	.867	97.017	.000
Compatibility	5	.902	.855	84.099	.000
Complexity	5	.852	.809	69.016	.000
Trialability	5	.748	.630	54.903	.000
Observability	5	.930	.788	129.164	.000

Data Analysis

The research data were analyzed in order to provide answers for the three research questions as follows:

The first research question: What are the attributes of online learning acceptance of the students during the COVID-19 pandemic? The research data in this part were analyzed with the statistical procedures of exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The data from 386 sets of questionnaire were randomly divided into two groups for construct validation. The first group consisting of 184 sets of questionnaire was statistically analyzed with exploratory factor analysis (EFA); while the second group also consisting of 184 sets of questionnaire was statistically analyzed with confirmatory factor analysis (CFA).

The second research question: What are the levels of online learning acceptance of the students in each component attribute? To obtain answers for this research question, the research team summated the rating scales of each item in the same component attribute as mentioned in the first research question, and then analyzed them with descriptive statistics of mean, standard deviation, skewness and kurtosis.

The third research question: Are the levels of online learning acceptance during the COVID-19 pandemic of students with different personal background factors different or not, and how? To obtain answers for this research question, the research team analyzed the data with the statistical procedure of multivariate analysis of variance (MANOVA).

Research Results

Findings about Construct Validity

The research team considered the structure and measurement of the five attributes based on the DOI theory obtained from the survey with the use of the questionnaire. They used in-depth data from previous research literature to create the mapping of attributes of acceptance of online learning during the COVID-19 pandemic. Then the randomly selected first group of data (n = 184) in the 25 items were analyzed to verify the model with exploratory factor analysis (EFA) of the five attributes, i.e. relative advantage, compatibility, complexity, trialability, and observability; after that, orthogonal varimax rotation of axis was operated. Also, KMO and Bartlett test were applied to again determine whether or not this group of data (n = 184) was appropriate for factor analysis. As such, Hair, et. al., (2010) suggest that KMO should be higher than .60, the Bartlett test should be significant, and each item should have loadings higher than 0.50, while there should be no cross-load item. The analysis results showed that KMO was 0.951 and Bartlett test results were significant ($\chi^2 = 6,794.454$; p-value = 0.000). Therefore, it can be concluded that the data were suitable for factor analysis.

After that was the consideration of analysis results of components of the 25 items. It was found that the former 5 component attributes were reorganized into 3 factors with Eigenvalue of higher than 1. The Eigenvalues, percentage of variance, and percentage of total variance of the three factors are shown in Table 3 below:

Table 3: *Attributes of acceptance of online learning during the COVID-19 pandemic*

Factors	Eigenvalue	Percentage of Variance	Percentage of Total Variance
1. Perceived benefits	9.356	37.422	37.422
2. Complexity	3.754	15.015	52.437
3. Trialability	2.719	10.878	63.315

As shown in Table 3, it can be seen that the items on former 3 principal component attributes based on the DOI theory, i.e. relative advantage, compatibility, and observability

could not be separated based on the former structure of the theory, because they were recombined to become one attribute under the new name of perceived benefits; while the items on attributes of complexity and trialability could still be used for measurement of those attributes. The variances of the three components ranged from 10.878 % to 34.422 %, and the combined variance of the three components was 63.315 %. The factor loadings of the items for the three components are shown in Table 4 below:

Table 4: *Item factor loadings regarding acceptance of online learning during the COVID-19 pandemic*

Attributes	Items	Factor Loadings		
		1	2	3
Perceived benefits (Relative advantage, Compatibility and Observability)	OBS5	.861		
	OBS1	.847		
	RA5	.833		
	COM1	.808		
	OBS4	.800		
	OBS2	.794		
	OBS3	.793		
	RA4	.792		
	RA3	.780		
	COM2	.774		
	COM3	.767		
	COM4	.726		
	COM5	.709		
	RA2	.567		
RA1	.498			
Complexity	CPX2		.881	
	CPX4		.879	
	CPX3		.871	
	CPX5		.758	
	CPX1		.689	
Trialability	TRIA2			.793
	TRIA1			.695
	TRIA5			.650
	TRIA3			.636
	TRIA4	.506		.524

Results as shown in Table 4 reveal that the RA1 item had factor loading value in factor 1 of less than 0.50 and the TRIAL 4 item had cross-load factors (Hair, et. al., 2010). So, the research team deleted these two items and then analyzed the data again. The results are shown in Table 5 below:

As shown in Table 5, the percentage of variance of the three attributes ranged from 10.464 to 38.911, and the combined variance of the three attributes was 65.557. As for the factor loading of each attribute, it was found that attribute 1 (perceived benefits) had factor

loadings between .563 - .864, attribute 2 (complexity) had factor loadings between .688 - .882, and attribute 3 (trialability) had factor loadings between .642 - .797. Furthermore, in order to re-confirm the appropriateness of structure of the variables, the research team conducted the confirmatory factor analysis (CFA) of the second group of data (n = 184). Analysis results showed that factor loadings of TRIAL3 and TRIAL5 items were lower than 0.50. So, the two items were deleted from the model and then the model was re-analyzed. The re-analysis results showed that the factor loading of every item was not lower than 0.50.

Table 5: *Re-analysis of item factor loadings regarding acceptance of online learning during the COVID-19 pandemic*

Attributes	Items	Factor Loadings		
		1	2	3
Perceived benefits (Relative advantage, Compatibility, and Observability)	14	.563 - .864		
Complexity	5	.688 - .882		
Trialability	4	.642 - .797		
Eigenvalue		8.949	3.722	2.407
Percentage of Variance		38.911	16.182	10.464
Percentage of Total Variance		38.911	55.092	65.557
KMO = .948, Barlett tests of Sphericity; $\chi^2 = 6,401.586$; p-value = 0.000				

Confirmatory factor analysis (CFA) results of the measurement scales testing revealed the support for the three constructs model indicating the exclusiveness of the constructs used ($\chi^2 = 438.588$, df. = 176, $\chi^2/df.$ = 2.492, CFI = .957, GFI = .902, RMSEA = .062, RMR = .0679), as depicted in Table 6. The values obtained for the specified indices are regarded as indicators of good fit values in model studies (Kline, 2005; Tabachnick and Fidell, 2007). The findings indicated that the three-factor structure of the model had been confirmed as a result of the confirmatory factor analysis.

Table 6 reveals that all scales were reliable. As for convergent validity to establish the validity of constructs, the items of each construct should share a high proportion of variances in common. As revealed in Table 6, the convergent validity is indicated by: (1) all standardized loadings were significant and higher than 0.50; (2) Cronbach's alpha of all constructs were not less than .70; (3) CR of all constructs were higher than 0.70, and (4) the AVEs were higher than 0.50, providing evidence in support of the measures' reliability (Hair, et. al., 2010).

The analysis results as shown in Tables 3 - 6 can be concluded to indicate that the acceptance of online learning during the COVID-19 pandemic clearly has three attributes, i.e. perceived benefits, complexity, and trialability.

For the model's reliability analysis, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) were calculated for all latent variables' measurement scales. The results are shown in Table 6 below:

Table 6: Overall CFA for the modified constructs

Construct & indicators	Standardized loadings	Indicator Reliability	Cronbach alpha	CR	AVE			
Perceived benefits	0.878	0.771						
OBS1	0.868	0.753						
OBS5	0.824	0.679						
RA5	0.816	0.666						
OBS3	0.808	0.653						
RA3	0.806	0.650						
OBS2	0.801	0.642	.962	.959	.626			
RA4	0.793	0.629						
OBS4	0.785	0.616						
COM3	0.784	0.615						
COM2	0.779	0.607						
COM1	0.751	0.564						
COM5	0.733	0.537						
COM4	0.621	0.386						
RA2								
Complexity	0.892	0.796					.897	.638
CPX4	0.855	0.731				.887		
CPX3	0.850	0.723						
CPX2	0.734	0.539						
CPX5	0.627	0.393						
CPX1								
Trialability				.704	.545			
TRAI1	0.796	0.634	.712					
TRAI2	0.675	0.456						

$\chi^2 = 438.588$, $df. = 176$, $\chi^2/df. = 2.492$, CFI = .957, GFI = .902, RMSEA = .062, RMR = .0679

Findings about Levels of Acceptance of Online Learning during the COVID-19 Pandemic

For this part, the research team combined the two groups of data as a whole ($n = 386$) and then summated the rating scores of items in each attribute to show the rating means, standard deviations, skewness levels, and kurtosis levels in order to interpret the levels of acceptance of online learning during the COVID-19 pandemic of the students. The results are shown in Table 7 below:

Table 7: Assessing to acceptance of online learning during the COVID-19 pandemic

	Items	Mean	SD.	Skew	Kurt	Level of Acceptance
Perceived benefits (PEBE)	14	3.1269	.84788	-.020	.249	Moderate
Complexity (CPX)	5	3.0762	.84466	.192	.012	Moderate
Trialability (TRIAL)	2	2.2964	.84610	.485	-.096	Low

From Table 7, it can be seen that as a whole, all students in the three study programs and all class year levels accepted the perceived benefits and the complexity attributes of online learning during the COVID-19 pandemic at the moderate level; while they accepted the trialability attribute of online learning at the low level.

Findings about Influences of Personal Background Factors of the Students on Acceptance of Online Learning during the COVID-19 Pandemic

In this part, the research team used the statistical procedure of multivariate analysis of variance (MANOVA) to test the influences and effect sizes of personal background factors of the students on acceptance of online learning during the COVID-19 pandemic.

The first step was to find out the correlation levels of the three attributes as shown in Table 8 below:

Table 8: *Correlation of attributes of acceptance of online learning during the COVID-19 pandemic*

	Perceived benefits		Complexity	
	r	p-value	r	p-value
Complexity	-.390	.000		
Trialability	.420	.000	-.199	.000
Gender	Box's M = 3.036, f-test = .496, df1 = 6, df2 = 95,451.207, p-value = .812			
Study program	Box's M = 12.310, f-test = 1.004, df1 = 12, df2 = 146,627.582, p-value = .441			
Class year level	Box's M = 15.011, f-test = .810, df1 = 18, df2 = 146,627.582, p-value = .441			

As shown in Table 8, the three attribute factors of acceptance of online learning correlated significantly. The correlation between perceived benefits and trialability was positive and highest, followed by the correlation between perceived benefits and complexity which was negative, and finally the correlation between trialability and complexity which was also negative. After that, the research team tested the equality of covariance matrices with the use of Box's test. It was found that the students' three personal background factors (gender, study program, and class year level) had equal covariance for every attribute. Therefore, the analysis results showed that it was appropriate for using MANOVA for comparison of the means of many variables. Results of MANOVA analysis are shown in Table 9 below:

Table 9: *Multivariate test for acceptance of online learning during the COVID-19 pandemic*

Personal Background Factors of Students	Perceived benefits		Complexity		Trialability		
	Mean	SD.	Mean	SD.	Mean	SD.	
Gender	Male (n=125)	2.506	0.849	3.070	0.850	3.164	0.893
	Female (n=261)	2.196	0.828	3.079	0.844	3.109	0.827
Multivariate Test by Wilks' Lambda = 0.025, p-value = .000, Observed Power = .897							
Study Program	DigiTechBus (n=69)	2.689	0.732	3.145	0.848	3.304	0.850
	DigiTechDesign (n=120)	2.596	0.795	3.082	0.806	3.158	0.862
	CommArts (n=197)	1.976	0.791	3.049	0.869	3.046	0.832
Multivariate Test by Wilks' Lambda = 0.802, p-value = .000, Observed Power = 1.000							
Class Year Level	The 1st year (n=100)	2.373	0.891	3.152	0.816	3.340	0.876
	The 2nd year (n=98)	2.192	0.835	3.155	0.904	2.995	0.842
	The 3rd year (n=91)	2.162	0.729	3.130	0.821	3.159	0.722
	The 4th year (n=97)	2.450	0.889	2.868	0.812	3.010	0.898
Multivariate Test by Wilks' Lambda = 0.930, p-value = .001, Observed Power = .978							

The results appeared in Table 9 as indicated by Wilks' Lambda of multivariate test show that the dependent variables as classified by personal background factors of the students (gender, study program, and class year level) had rating means that were significantly different. So, the research team conducted the testing further with the statistical procedure of analysis of variance (ANOVA). The results are shown in Table 10 below:

Table 10: *Univariate test*

Personal Factors	Dependent var.	df	F	p-value	Partial Eta Squared	Observed Power
Gender	PEBE	1	11.621	.001	.029	.925
	CPX	1	.009	.926	.000	.051
	TRAIL	1	.353	.553	.001	.091
Study Program	PEBE	2	34.029	.000	.151	1.000
	CPX	2	.334	.716	.002	.103
	TRAIL	2	2.517	.082	.013	.503
Class Year Level	PEBE	3	2.639	.049	.020	.644
	CPX	3	2.673	.047	.021	.650
	TRAIL	3	3.626	.013	.028	.794

Data from students in the research sample indicated that the levels of acceptance of online learning during the COVID-19 pandemic of male and female students were significantly different in the attribute of perceived benefits with the power to detect the effects = 0.925. As shown in Table 9 and from the multiple comparison analysis, it is clear that male students tended to accept the perceived benefits attribute of online learning at the higher level than that of female students; while the attributes of complexity and trialability were accepted by male and female students at the similar levels.

Regarding the comparison of difference in the levels of acceptance of online learning during the COVID-19 pandemic of students in the three study programs, significant differences were found in their levels of acceptance of the perceived benefits attribute with the power to detect the effects = 1.00. As shown in Table 9 and from the multiple comparison analysis, it is clear that students in the Digital Technology for Business Program accepted the perceived benefits attribute at the same level with that of students in the Digital Technology for Design Program, and students in these two groups tended to accept the perceived benefits attribute at the clearly higher level than that of students in the Communication Arts Program. Meanwhile, the attributes of complexity and trialability were accepted by students in the three programs at the similar levels.

Regarding the comparison of difference in the levels of acceptance of online learning during the COVID-19 pandemic of students in the four class year levels, significant differences were found in their levels of acceptance of all three attributes with the power to detect the effects ranging from .644 to .794. As shown in Table 9 and from the multiple comparison analysis, it is clear that first year students and fourth year students tended to accept the perceived benefits attributes at the higher level than those of students in other class year levels. As for the complexity attribute of online learning, it was found that the fourth year students tended to accept the complexity attribute at the lower level than those of students in other class year levels; and for the trialability attribute of online learning, it was found that the first year students acknowledged that they could experiment with online learning at the higher level than those of students of other class year levels.

Discussion and Conclusion

Regarding conclusion of research results, it is found that the acceptance of online learning during the COVID-19 pandemic comprised three component attributes, i.e. perceived benefits, complexity, and trialability; while the original three attributes of relative advantage, compatibility, and observability could not be separated and consequently were combined into the new attribute of perceived benefits. This is probably because during the COVID-19 pandemic the students received the same educational service without other alternative and in compliance with the situation and measures for prevention of the spread of COVID-19 disease. The three original attributes were combined because they are relatively similar in terms of benefits of online learning, which is consistent with the definitions given by Rogers (2003) that relative advantage is the degree to which an innovation is seen as advantageous to a current practice; compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters; and observability is the degree to which the results of an innovation are visible to others.

However, the research results indicate that the students had the opinions that perceived benefits of online learning were at the moderate level. This is probably because the students in the Faculty of Information and Communication Technology have to study in the study programs that require the uses of materials, studio rooms, connecting devices, and computers with high quality for their work performance and practice. So, when the pattern of learning was transformed from the conventional learning in the laboratory to become the online learning, the students perceived that the new pattern of learning was consistent with their learning characteristics, provided benefits from online learning in the laboratory, and provided outcomes of online learning at the moderate level. This research result is in agreement with the previous research study conducted by Ingard et al. (2020) which found that when the COVID-19 pandemic had occurred and the conventional pattern of learning had been adjusted to become online learning, the students had high level of anxiety in their learning, especially the anxiety about doing difficult learning activities assigned by the instructor and about not being able to fully use the learning media and equipment. Another research finding is that the students perceived that the complexity level of online learning was at the moderate level. This is probably because the online learning during the COVID-19 pandemic as reported in this research was the online learning during the new round of the pandemic prior to which the first year – fourth year students had had previous experiences. Consequently, they perceived that the online learning they were experiencing was not highly complex.

Regarding results of comparing the rating means of the three component attributes as classified by personal background factors of the students, it is found that male students tended to accept the attribute of perceived benefits at the significantly higher level than that of female students. This finding is in agreement with the previous finding of the research conducted by Ghaleb et al. (2021) which implied that male students had the ability for self-adjustment and coping with critical situations at the higher level than that of female students. This is according to the results of a study examines the stability and interrelationship of students' attitudes and participation during online university courses, and the moderating influence of gender of Nistor (2013) found that gender effects comprised male students' more stable attitudes, and female students' more stable participation.

Based on this research finding, the educational institution administrators and instructors should provide advices and directions for students to enable them to understand the situation so that there is no problem in their learning. In addition, the comparison results also reveal that

students in the Digital Technology for Business Program and students in the Digital Technology for Design Program accepted the attribute of perceived benefits at the same level. This is probably because the students in these two programs have similar learning activities and work assignments; therefore, they have similar attitudes and viewpoints. The research findings also reveal that students in these two study programs tended to accept the attribute of perceived benefits at the clearly higher level than that of students in the Communication Arts Program. This research finding is in agreement with the previous research study conducted by Ingard et al. (2020) which found that students in the Communication Arts Program had higher anxiety toward online learning at the higher level than that of students in the Digital Technology Program. Therefore, educational institution administrators, program instructors and classroom instructors of the Communication Arts Program should share their understanding with students in the program and take care of them thoroughly. Finally, another important finding is that the first year students tended to acknowledge that they had experimented with online learning at the higher level than those of students in the other year levels. This is probably because the first year students just came to study in the Faculty for the first year. As new students, they had received advices on spending their lives and times in the university, especially on learning that had been adjusted to become online learning from the start of the semester. As such, they had received the advices from the Faculty executives, course instructors, academic advisors, and senior students in the same and other faculties. The experiences and advices they had received enabled them to perceive that they had experimented with online learning at the higher level than those of students in the other class year levels. Therefore, this research finding cannot absolutely be overlooked. Those who are involved with online learning of students in every class year level and every program must provide advices on online learning to the students before learning, during learning, and after learning. Also, they must provide advices to the students to enable them to experiment with the actual uses of various functions of the platforms used by the instructors in online learning management.

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