E-LEARNING USER INTERFACE ACCEPTANCE BASED ON ANALYSIS OF USER'S STYLE, USABILITY AND USER BENEFITS

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Abstract

E-learning does not function properly if the system is not in accordance with user needs. This study aims to establish an evaluation model for e-learning user interface according to user acceptance. The model is designed based on three categories: user learning style, usability and user benefits. Results of measurements of the three categories will determine the level of user acceptance of the e-learning interface. The data were taken using a questionnaire which was distributed to 125 ELS students from various countries. Then processed using SEM and Lisrel v8.80. This paper presents experimental set up for the general research and some results for technology acceptance theories.

Keywords: *e-Learning, User Interface, User's Style, Usability, User Benefit.*

Abstrak

E-learning tidak akan berfungsi dengan baik jika sistem ini tidak sesuai dengan kebutuhan pengguna. Penelitian ini bertujuan untuk membangun sebuah model evaluasi untuk antarmuka pengguna *e-learning* sesuai dengan penerimaan pengguna. Model ini dirancang berdasarkan tiga kategori: gaya belajar pengguna, kegunaan, dan manfaat pengguna. Hasil pengukuran dari tiga kategori akan menentukan tingkat penerimaan pengguna antarmuka *e-learning*. Data diambil dengan menggunakan kuesioner yang dibagikan kepada 125 siswa ELS dari berbagai negara. Kemudian diolah dengan menggunakan SEM dan Lisrel v8.80. Paper ini menyajikan *set up* eksperimental untuk penelitian umum dan beberapa hasil untuk teori penerimaan teknologi.

Kata kunci: *e-Learning, User Interface, Style Pengguna, Usability, Manfaat Pengguna.*

1. Introduction

E-learning is a method of learning that is offered by many universities and educational institutions to support their learning process. Basically, the concept of e-learning is the provision of equal educational facilities to learn in a conventional school. The role of e-learning is expected to help the role of educational institutions an conventional training. E-learning process has different characteristic compared to common education. According to [1] E-learning has personalized for student, focused on student and is directly controlled by themselves, occurs only when required and has the strictly necessary duration, communicated by technology on the basis student has gotten knowledge and need proactive roles.

The e-learning is a distance learning system which offers training courses and custom tailors to the needs of learners. An integrated environment which combines the advantages of e-learning and traditional classroom is called as blended e-education [2]. But, unused user interfaces are probably the single largest reasons why on all sides of interactive system computers and e-learning fall in actual use. The design of applications purposes in term of ease of use is not an easy task [3]. E-learning will become less optimal if the system is not effective used in accordance with user needs [1].

2. Related Theories

2.1. User Interface Evaluation

The system interface is used to communicate with a user in an interactive system. The system interface can be divided into two sections; a front interface and back-end interface [1]. E-learning interface design is especially critical, as the learning effectiveness and interface design are substantially intertwined. To design an e-learning interface should be determined by how people learn and the tasks they need to perform in the program. There are some features in the user interface that are still less efficient [3]. Many theories that discuss the interface evaluation design, but the fact still weak and does not work in accordance with the e-learning user interface expected [4]. Table I shows the related works in e-learning user interface acceptance.

TABLE I
E-LEARNING USER INTERFACE EVALUATION

Model	Research Variables
Criteria for interface design and evaluation, Scapin (1990)	user explicit control, adaptability, error management, compatibility, guidance, consistency, user workload, significance of codes
Quantitative Evaluation, Olga, (2004)	Speed of user's work, Complexity user's work, user's mistakes, Speed of studying, Subjective satisfaction
AHP Model. Yong et.al (2007)	Interaction Support, Function Support, User Support, Information Support, Device Capacity
HELAM (Hexagonal e-learning Assessment Model), Ozkan (2009)	system quality, service quality, content quality, learner perspective, instructor attitudes, supportive issues.
Inherent Structure in e-learning, Sfenrianto et.al. (2011)	Learning style, Motivation, Knowledge-ability

"The often problem is that it is impossible to determine which user interface design variant is better" [5]. Empirical evaluation of subjective selection criteria cannot be the best interface. Therefore quantitative evaluation methods are needed user interface. Different interface designs can be evaluated with quantitative methods priority criteria. While [3] argues that interface design e-learning should be a goal, an integrated component of the overall e-learning products.

User interface becomes the major channel to convey information in e-learning context: a well-designed and friendly interface is thus the key element in helping users to get the best results quickly [6]. Interface settings will affect the quality of students learning that accommodates their needs in terms of personalizing the content, structure, and presentation.

2.2. User's Learning Style

User's Learning or Style User's Style is student factors in learning such as, learning style, motivation, and knowledge ability. User learning style should be considered in the adaptive e-learning development in order to optimize learning process [7].

Learning Style refers to how a learner perceives, interacts with, and responds to the learning environment; it is a measure of individual differences [8]. According to [9] User Learning Style is developed from the individual's physiological characteristic, will be influenced by: 1) Psychology development, social environment and education experience. 2) Learning time, study habits, learning approach, gender, ethnicity, learning time, the learning resource and the process of learn. 3) Record the learning information for each student: the individual learning style, preferred study habits, learning approach, his dynamic learning situation and even detail information.

Learning motivation is an individual's characteristic and consistent approach to organizing and processing information. The students learning motivation is divided into five categories: effort, confidence, satisfaction, sensory interest and cognitive interest [7]. From these categories, effort is a fundamental indicator of a student's motivation. The exertion of effort in learning can be as a positive parameter. The student's effort is the amount of time the learner spends on learning and participation.

The student's ability is also another factor that should be considered. The student's ability can be seen from the level of knowledge in their learning performance. To measure the learning performance is recognising the knowledge objectively through evaluation, such as quiz, class exercise, and exam [7].

2.3. Usability Evaluation

Usability is a quality attribute that assesses how easy user interfaces are to use. The word "usability" refers to a method for improving easy of use during the design process [10] [11] [12]. Definition of usability based on 3 different standardization organizations: A set of attributes that bear on the effort needed for use and on the individual assessment of such use, by a stated or implied set of users (ISO/IEC 9126, 1991). The extent to which a product can be used by specified users to Achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (ISO 9241 to 11.1998). The ease with which a user can learn to operate,

prepare inputs for, and interpret outputs of a system or component (IEEE Std.610.12-1990) [13].

Usability is important to determine whether something is useful. It matters that something is easy but it is not what you want [5][14][15]. Although there are many individual methods for evaluating usability; they are not well integrated into a single conceptual framework that facilitate their usage by developers. There are several standards or conceptual models for usability, and not all of this standards or models describe the same operational definitions and measures [16]. It needs a measurement model and a structural model for evaluating the e-learning user interface acceptance model [8] [17].

2.4. The Technology Acceptance Model (TAM)

There are several models that are built to analyze and understand the variables that affect the user acceptance of information technology [18], among others; Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), and the Technology Acceptance Model (TAM). TAM models are developed from a psychological theory, which describes the behavior of computer users that are based on beliefs, attitudes, desires and relationships user behavior. These models aim to explain the main factors of user behavior on user acceptance of technology as refered in Figure.1. This model places the attitudinal factors of individual user behavior with variables: ease of use (ease of use), utility (usefulness), use (Attitude Toward Using), behavior to keep using (Behavioral Intention To Use), the real conditions of use of the system (Actual System Usage).

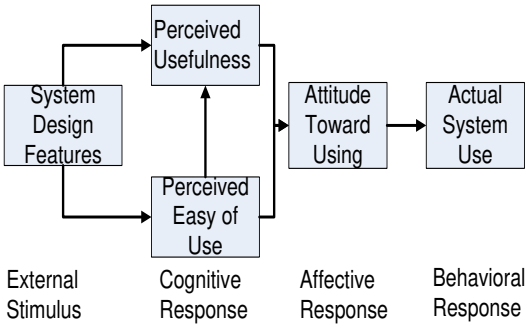

Fig 1. TAM Evaluation Theory

3. Research Design

3.1. Research Hypothesis Model

User Interface Acceptance in this interface evaluation focuses on 12 indicator variables [Figure. 2]:

ξ =User Interface Acceptance; η_1 = User's Style; η_2 =Usability; η_3 =User Benefit y_1 =Knowledge ability; y_2 =Motivation; y_3 =Learning Style; y_4 =Knowability; y_5 =Operability; y_6 =Efficiency; y_7 =Robustness; y_8 =Safety; y_9 =Subjective Satisfaction; y_{10} =Media elements; y_{11} =Communicativeness; y_{12} =User Expectation. The complete description about this research hypotheses as shown in Figure 3.

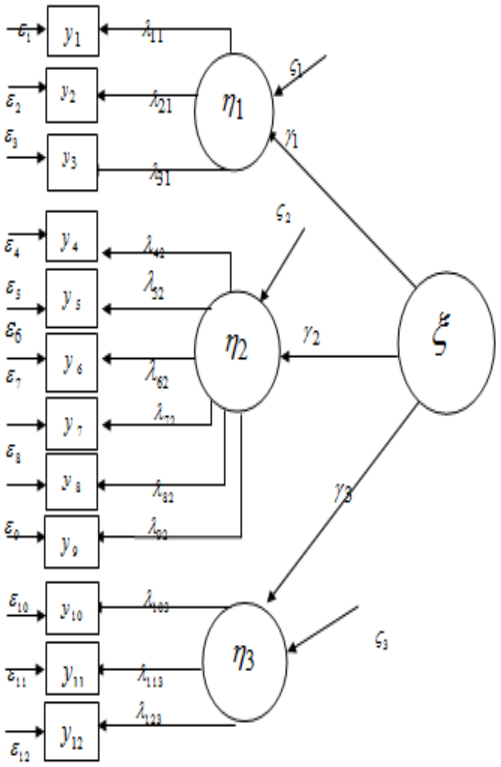

Fig 2. Research Hypotheses

The model of User Interface Acceptance in this study is a model 2ndCFA. For each of the research hypotheses will be defined in a statistical hypothesis testing is necessary as a means of hypothesis. Testing multiple statistical hypotheses through estimation of the parameters γ and λ contained in the research and LISREL models. In statistical hypothesis H_0 if the corresponding parameter is zero, while H_a if the parameter is not zero. Thus if H_0 is rejected, it means that the research hypotheses concerned accepted. As for some of the hypotheses for this research are as referred in Figure 3.

$H_{11_0} : \lambda_{11} = 0$	$H_{11_a} : \lambda_{11} \neq 0$	$H_{21_0} : \lambda_{21} = 0$	$H_{21_a} : \lambda_{21} \neq 0$
$H_{31_0} : \lambda_{31} = 0$	$H_{31_a} : \lambda_{31} \neq 0$	$H_{42_0} : \lambda_{42} = 0$	$H_{42_a} : \lambda_{42} \neq 0$
$H_{52_0} : \lambda_{52} = 0$	$H_{52_a} : \lambda_{52} \neq 0$	$H_{62_0} : \lambda_{62} = 0$	$H_{62_a} : \lambda_{62} \neq 0$
$H_{72_0} : \lambda_{72} = 0$	$H_{72_a} : \lambda_{72} \neq 0$	$H_{82_0} : \lambda_{82} = 0$	$H_{82_a} : \lambda_{82} \neq 0$
$H_{92_0} : \lambda_{92} = 0$	$H_{92_a} : \lambda_{92} \neq 0$	$H_{103_0} : \lambda_{103} = 0$	$H_{103_a} : \lambda_{103} \neq 0$
$H_{113_0} : \lambda_{113} = 0$	$H_{113_a} : \lambda_{113} \neq 0$	$H_{123_0} : \lambda_{123} = 0$	$H_{123_a} : \lambda_{123} \neq 0$
$H_{134_0} : \gamma_{134} = 0$	$H_{134_a} : \gamma_1 \neq 0$	$H_{144_0} : \gamma_2 = 0$	$H_{144_a} : \gamma_2 \neq 0$
$H_{154_0} : \gamma_3 = 0$	$H_{155_a} : \gamma_3 \neq 0$		

Fig 3. Research Hypotheses

We can see the User Interface Acceptance Model attributes as shown in tables II.

TABLE II
USER INTERFACE ACCEPTANCE ATTRIBUTES

Var.	GOALS	ATTRIBUTES
	User Profile (descriptive analysis)	Ethnicity
Y1	Knowledge ability	Grades
Y2	Motivation	CIEP Level
Y3	Learning style	learning time study habits
Y4	Knowability	Learnability, Understandability Memorability
Y5	Operability	Ease of use Effectiveness Flexibility
Y6	Efficiency	User workload Efficiency Productivity
Y7	Robustness	Error Management Trustfulness Errors
Y8	Safety	Safety Secure Comfortable
Y9	Subjective Satisfaction	Attractiveness Compliance Satisfaction
Y10	Media element	Usefulness Completeness Increase
Y11	Communicativeness	Simple Intuitive Perceptive
Y12	User Expectation	User need Capability Expectation

4. Results and Analysis

The questionnaires was distributed to 125 ELS language Center students in Malaysia who come from 13 countries (Figure 4). The minimum sample size recommended [19] for the sample in this study, depending on the number of variables to be studied. The formula is as follows: k (k+1) / 2, where k is the number of variables. it needs at least samples to calculate the minimum model of in this research is 12 (12 +1) / 2 = 78 samples.

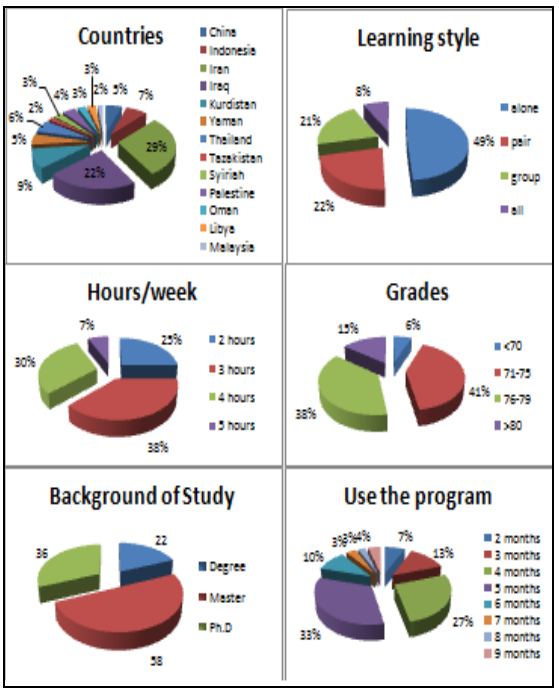

Fig 4. Research Respondents

The data collected in this study is ordinal data and the estimation method used is the method of ML (maximum likelihood). The data was processed by using SEM and Lisrel v8.80. The result of model measurement is very significant correlation between variables. Variable User's style, consisting of Y1, Y2, Y3, which also correlated with variables Y11, Y12. Usability of e-learning system, consisting of Y4, Y5, Y6, Y7, Y8, Y9, Y10 plus correlation with variable Y2, and the last indicator User's benefit, consisting of Y10, Y11, Y12, plus variable Y5, Y6, Y9 as shown in Figure 5 & Figure 6. Model I mesurement results in Figure 5: User's Style = t value = 8.09, γ =0.73, R^2 = 0.53. Usability = t value = 7.42, γ =0.96, R^2 = 0.92. User Benefits = t value = 7.04, γ =0.80, R^2 = 0.63. Model II mesurement results in Figure 6: User's Style = t value = 8.43, γ =0.77, R^2 = 0.59. Usability = t value = 7.83, γ =0.95, R^2 = 0.90. User Benefits = t value = 7.51, γ =0.84, R^2 = 0.71.

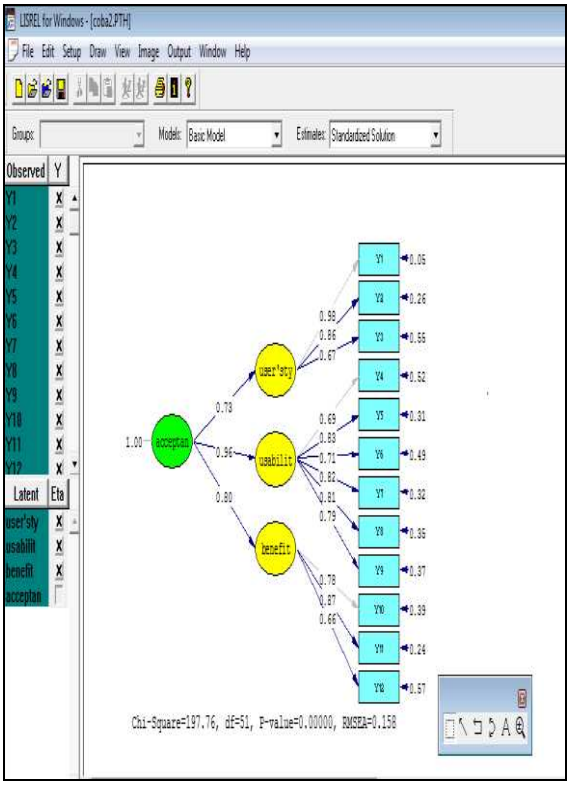

Fig. 5 Model I Initial Measurement

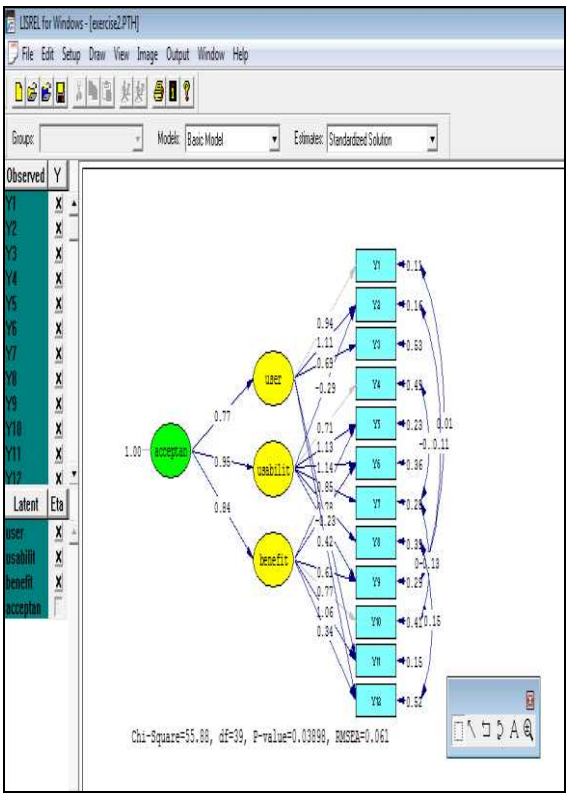

Fig 6. Model II Suggestion Measurement

TABLE III
RESEARCH HYPOTHESIS RESULTS

Name	Lambda Gamma	t value	H_0	Research Hypothesis
Knowledge ability	2.90	*		
Motivation	1.18	5.41	rejected	H21 accepted
Learning style	0.66	7.20	rejected	H31 accepted
Know-ability	1.21	6.98	rejected	H42 accepted
Operability	0.84	6.12	rejected	H52 accepted
Efficiency	0.66	6.89	rejected	H62 accepted
Robustness	1.36	6.18	rejected	H72 accepted
Safety	0.84	6.32	rejected	H82 accepted
Subjective Satisfaction	1.74	6.47	rejected	H92 accepted
Media element	0.93	5.58	rejected	H103 accepted
Communicative	0.97	3.80	rejected	H113 accepted
User expectation	5.54	6.66	rejected	H123 accepted
User style	0.73	8.09	rejected	H134 accepted
Usability	0.96	7.42	rejected	H144 accepted
User Benefit	0.80	7.04	rejected	H154 accepted

TABLE IV
VARIANCE EXTRACTED AND
CONSTRUCT RELIABILITY OF MODEL

Variables	Construct Reliability (>0.70)	Variance Extracted (>0.50)
User style	0.88	0.71
Usability	0.90	0.61
User Benefit	0.82	0.60
Acceptance	0.73	0.69

Based on the statistical data, the model of e-learning user interface, has a highly significant correlation values and strong construction between variables, which is evidenced by the size of the construct reliability values above 0.70 and the value of its variance extracted 0.50. T value exceeds the critical value also has a significant level of 1.96 to 0.05 which means that the relevant variables significantly related to the concept of design-related. The high load factor (0.70) of each variable also proves the strength of the relationship between variables with its constructs (table III and table IV).

Research generates model was estimated before we tested the Goodness of fits of the user interface acceptance model by using LISREL v8.80. The result of GOF measurement in this study also described information about the guidelines and limits the admissibility of GOF levels as shown in Table V.

Table V shows the goodness of fit statistical theories implied in this study, column 1 represents the goodness of fit theories, column 2 indicator the target, column 3 is model I measurement and column 4 is model II measurement. *Chi-square* value shows the deviation between the sample covariance matrix and the model (fitted)

covariance matrix. Chi-square is a measure of the poor fit of a model. Chi-square value of 0 indicates that the model has a perfect fit. *Goodness of fit indices* (GFI) is a measure of the accuracy of the model in generating observed covariance matrix. GFI value must be between 0 and 1. Although in theory GFI may have a negative value, but it should not happen, because the model has a negative value of GFI is the worst model of all existing models [10]. The model has a GFI values > 0.90 indicate a good model fit.

TABLE V
GOF STATISTICS FOR E-LEARNING INTERFACE ACCEPTANCE MODEL.

Goodness of Fit	Statistics Measurement Target	Model I	Model II
	Absolute Fit Measures		
X^2	Smaller grades is better	197.76	55.88
NCP	Smaller grades is better	146.76	16.88
SNCP	Smaller grades is better	1.82	0.51
GFI	GFI $\geq$ 0.90	0.78	0.93
RMSR	RMSR $\leq$ 0.05	0.80	0.31
RMSEA	RMSEA < 0.08	0.158	0.061
ECVI	Smaller grades is better	2.19	1.16
	Incremental Fit Measures		
TLI or NNFI	NNFI $\geq$ 0.90	0.90	0.98
NFI	NFI $\geq$ 0.90	0.90	0.97
AGFI	AGFI $\geq$ 0.90	0.66	0.85
RFI	RFI $\geq$ 0.90	0.87	0.95
IFI	IFI $\geq$ 0.90	0.92	0.99
CFI	CFI $\geq$ 0.90	0.92	0.99
	Parsimonious Fit Measures		
PGFI	Higher grades is better	0.51	0.46
Normed X^2	Minimun grades: 1.0 Maximum grades: 3.0	4.10	1.50
PNFI	Higher grades is better	0.69	0.57
AIC	Smaller grades (positive) is better	251.76	133.88
CAIC	Smaller grades (positive) is better	353.10	280.27

Adjusted Goodness of Fit Index (AGFI) is the same as GFI, but had to adjust the influence of degrees of freedom in a model. Fit model is one that has the value of AGFI = 0.90. *RMSEA* is an indicator of model fit most informative. *RMSEA* measures the deviation of the parameter values in a model with population covariance matrix. RMSEA values> 0.05 identifies the model fit and RMSEA values ranging between 0.08 states that the model has a forecast error rasionable. RMSEA values ranged from 0.08 to 0.1 indicates that the model had sufficient fit, but if the value of RMSEA> 0.1 states that the value of a model fit very ugly.

Expected cross validation index (ECVI) was used to assess the trend that the model, in a single sample, can be cross-validated on the sample size and the same population. ECVI measures the deviation between the fitted (model) covariance matrix of the sample being analyzed and the covariance matrix that would be obtained in other samples but has the same sample size. ECVI value models ECVI lower than that obtained in the model saturated and independence models, indicating that the model is fit. AIC and CAIC are used to assess the issue of parsimony in the assessment of model fit. AIC and CAIC are used in the comparison of two or more models, where the value of AIC and CAIC smaller than the AIC model of saturated and independence means having a better model fit.

Normed Fit Index (NFI) and the *Comparative Fit Index* (CFI) ranges between 0 and 1 are derived from the comparison between the model and the hypothesized model of independence. A model is said to fit if it has a value of NFI and CFI> 0.90. While the *Non-normed Fit Index* (NNFI), is used to overcome the problems arising from the complexity of the model. Similarly, *Incremental Fit Index* (IFI) is used to overcome the problem of parsimony and sample size associated with NFI. While *Relative Fit Index* (RFI) is used to measure the fit where values between 0 and 1.

5. Conclusions and Recommendations

5.1. Conclusion

This paper presents how to develop the construct model among user's style, usability and user benefit as indicator variables to measure the latent variable of user e-learning interface acceptance. According to research questioners analysis and Goodness of Fit measurement, it is shown that the high reliability in this study indicates that an indicator variable has a consistently high in measuring latent constructs. Test reliability by using two types of measurements that measure construct composite reliability and variance extracted measure. According to t-value, loading factors, and the relative suitability value of each structural equation model, we can conclude that the interface User Acceptance Model for E-learning in this study can be accepted.

5.2. Recommendations

This study has become one alternative model to get the user acceptance of e-learning interface. Hopefully this model can be considered in developing an e-learning application in the future.

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