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Multi-criteria decision making on succesfull of online learning using AHP and regression

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Abstract. *This paper purposes comparing the view of system builder (expert system) using analitycal hierarchy process (AHP) and view of user (students) using regression method in elearning system STIKes-STMIK Hang Tuah Pekanbaru. This study uses some attributes to analyze and evaluate which affect the acceptance of elearning system success. In AHP, the attributes are categorized as criteria and grouped into some dimensions. These criteria and dimenssions are evaluated by some experts using analitycal hierarchy process (AHP) to assess priorities for elearning system. There are four dimensions, system quality (four criteria), learning information quality (three criteria), service quality (three criteria) and service support (three criteria) dimension. This system is also evaluated by filling out the questionnaire by students as user of elearning system using regression method. The attributes are used as independent variable, while the succesfull of elearning is dependent variable. The result of using AHP and regression system has a different. It also can show there are different view between users and system builder which should be considered by STIKes-STMIK Hang Tuah Pekanbaru.*

1. Introduction

Learning technology according to [1] suggests that "the use of technology in teaching and learning processes to be effective through collaboration enhances, integrates curriculum, enhances application of learning strategies, improves teacher communication, enhances community relations and global learners". Student access to technology is no longer a privilege: it is a prerequisite for full participation in high-quality education opportunities. Increasingly, important learning resources used by students and teachers are digital, making access to the Internet as basic as access to a library [2]. Due to concerns about the growth of learning technologies, IT system designers face a dilemma in designing IT systems accepted in the learning process. It is clear that the learning system designing online learning is very complex because the involvement of certain limited creativity beyond the existing theories is basically governed by the system and quality of the quality of information to be generated. Online learning technology can range from personal computers to customized IT systems to serve the diversity of demand in learning activities. To be successfully implemented, this IT system must first be accepted by the user. Therefore, the important question of intensive innovation in online learning systems is "what are the characteristics of online learning systems that are acceptable and successful?".

2. Research Metodology

2.1. Study design

Throughout the study of IT-based technologies, most studies have used the Model of Acceptance Technology (TAM) [3] for the use of new technologies with two dimensions of benefit and usage. The Technology Acceptance Model (TAM) is a development of TRA (Theory of Reasoned Action) and was first introduced by Davis in 1989. To select Multi Criteria of Decision Making on Elearning at STIKES-STMIK Hang Tuah Pekanbaru necessary to perform several stages of the process to be traversed to see what will be done and produced in this research. The steps that will be passed later can be seen in Fig. 1 below.

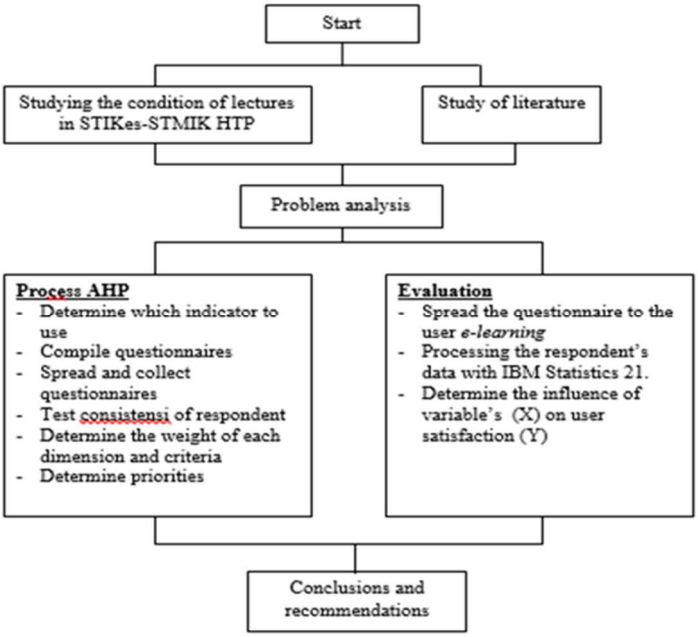

Figure 1 Research Show

2.2. MCDM Hierarchy Structure

Multi-Criteria Decision Making (MCDM) is a decision-making method to establish the best alternative of a number of alternatives based on certain criteria. Criteria are usually the sizes, rules or standards used in decision making. In general it can be said that MCDM selects the best alternative from a number of alternatives [3]. Here are some dimensions and criteria that will be used in this research.

2.3. Antecedents On IT-Based Learning System

Previous research using technology acceptance and information system success models has been identified about good information system attributes. In addition, the success model of information systems that can be used include system reliability (system reliability) and information quality [4]. Studies on [5] also found that from system reliability or system quality are reliability, flexibility, integration and accessibility. In addition, the quality of information is formed by completeness, accuracy, format and currency.

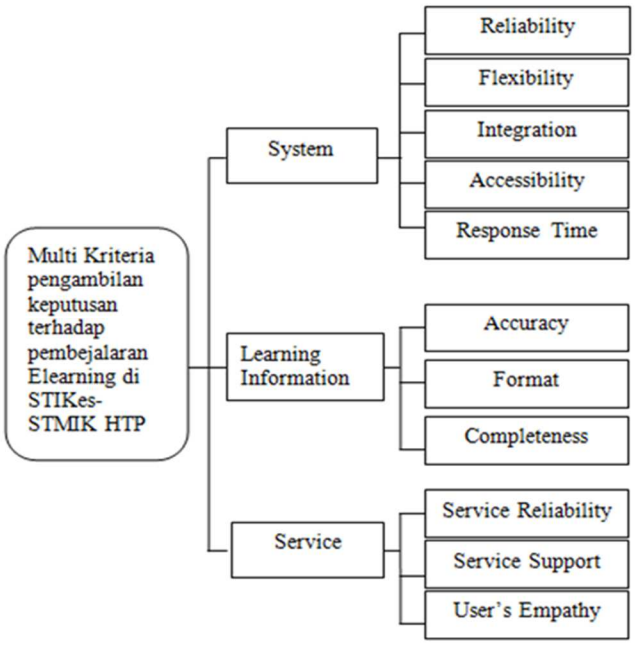

Figure 2. Structure of Hierarchy to Evaluate Multi-Criteria of Decision Making on Online Learning

In the above multi criteria will be made a questionnaire of each criterion. Then, the questionnaires were distributed and collected for consistency test on the data. Further processing the data and get the results of analysis of the data. From the results of data analysis will be obtained criteria that will be a priority on e-learning learning on campus STIKes-STMIK Hang Tuah Pekanbaru.

3. Analysis And Discussion

3.1. Consistency analysis

The first step of AHP (Analitycal Hierarchy Process) is to measure the consistency of the survey results of each respondent through two indicators namely, Consistency Index (CI) and Consistency Ratio (CR) [6][7][8]. This calculation is used to ensure that the value of the consistent ratio of CR <= 0.1. If CR> 0.1 then the matrix calculation should be stopped and recalculated or it can be said that the respondent can not be included in the next analysis. The survey was given to 10 respondents who conducted directly or via e-mail that took place in early February and late March 2017. Qualifications of respondents are presented in Table 1. They are chosen based on the following criteria, instructors or lecturers who use elearning in STIKes-STMIK Hang Tuah Pekanbaru environment, researchers who have done research on the acceptance of IT-based learning systems and programmers or developers. Each questionnaire is validated according to the consistency ratio.

Table 1 Expert Qualification

Professional background	Number of Respondents
Instruktur / Lecturer	6
Researchers	2
Programmer / Developers	2

The consistency analysis of all responses to the survey results is illustrated in Table 1. The results showed that the first respondents could not provide a consistent comparison at each comparison level.

At the first level of comparison (acceptance of IT-based learning systems), there are 6 respondents providing consistent responses (CR <0.1). At the next stage there is also the same thing. Of the total respondents who answered the questionnaire consistently, ie respondents # 2, # 4, # 5, # 6, # 7, # 9. Therefore, the respondent qualifies for the next step (weighting).

Table 2. Consistency Analysis of Each Pairwise Comparison Matrix

Respondent		Level 2. Acceptance of IT Based Learning			Level 3. System Quality			Level 3. Learning Information Quality			Level 3. Service Quality		
No.	Accepted	λ_{max}	CI	CR	λ_{max}	CI	CR	λ_{max}	CI	CR	λ_{max}	CI	CR
1	No	3,43644	0,21822	0,37624	13,17070	2,04268	1,82382	3,43644	0,21822	0,37624	3,43648	0,21824	0,37627
2	Yes	5,44171	0,11043	0,09860	5,44171	0,11043	0,09860	3,00369	0,00185	0,00318	3,03251	0,01926	0,03320
3	No	3,56304	0,28152	0,48538	14,22490	2,30623	2,05913	3,43644	0,21822	0,37624	3,43648	0,21824	0,37627
4	Yes	3,06489	0,03244	0,05594	5,42332	0,10583	0,09449	3,05362	0,02681	0,04623	3,06489	0,03244	0,05594
5	Yes	3,07127	0,03563	0,06144	5,28544	0,07136	0,06371	3,03851	0,01926	0,03320	3,05362	0,02681	0,04623
6	Yes	3,06489	0,03244	0,05594	5,45990	0,11497	0,10266	3,05362	0,02681	0,04623	3,02173	0,01086	0,01873
7	Yes	3,00702	0,00351	0,00605	5,05784	0,01446	0,01291	3,02906	0,01453	0,02505	3,08030	0,04015	0,06922
8	No	3,43644	0,21822	0,37624	8,41602	0,85400	0,76250	3,71136	0,35568	0,61324	3,56244	0,28124	0,48486
9	Yes	3,06489	0,03244	0,05594	5,42747	0,10687	0,09542	3,01415	0,00708	0,01220	3,05362	0,02681	0,04623
10	No	3,93915	0,46957	0,80961	7,49893	0,62473	0,55780	3,71136	0,35568	0,61324	3,18513	0,09256	0,15959

3.2. AHP Analysis

The next step, each element in each pairwise comparison matrix is consolidated with geometric mean (Geometric Mean). Matched matched matrices are presented in Table 3, Table 4 and Table 5. Table 3 shows the matrix results for a hierarchical level 2 structure of the dimensions of an IT-based learning system (OnLine Learning). According to this matrix, the priority weight of each criterion (System, Learning Information and Service) is identified by determining the eigenvectors.

Table 3. Pairwise Comparison Matrices for IT-Based Learning Acceptance

Acceptance	Sistem	L.Info	Service
Sistem	1	5	3
L.Info	0,2	1	0,3333333
Service	0,333333333	3	1
Λmax = 3,0385	CI = 0,0193		CR = 0,0332

The same step is also done on the matrix in table 3 and table 4. Next, determine the highest weights that will be selected to be an alternative.

Table 4. System Matrix

System	Reliability	Flexibility	Integration	Access	R.Time
Reliability	1	5	6	7	3
Flexibility	0,2	1	4	3	5
Integration	0,166666667	0,25	1	1	2
Access	0,142857143	0,333333	1	1	1
R. Time	0,333333333	0,2	0,5	1	1
	Λmax = 5,4417	CI = 0,1104		CR = 0,0986	

Table 5. AHP weighting and rank on Dimensions and Criteria using Excell 2010 and Expert Choice v.11 tools.

Dimension	Weights	Ranking	Criteria	Weight (Local)	Ranking (Local)
System	0,500	1	Reliability	0,2640	1
			Flexibility	0,1090	2
			Integration	0,0670	3
			Accessbility	0,0360	4
			Response Time	0,0240	5
Learning Information	0,359	2	Completeness	0,1170	2
			Accuracy	0,1880	1
			Format	0,0540	3
Service	0,141	3	Service Reliability	0,0310	3
			Service Support	0,0730	1
			User's Empathy	0,0370	2

Based on the results of weighting in table 5 above, it can be concluded that the criteria System has a dominant role with a weight of 0.500 (50%). The second rank is the Learning Information criteria with the overall weight of 0.359 (35.9%) and the third rank is Service with weight of 0.141 (14.1%). The next step is to test the analysis on each criteria available to see how much influence between these criteria on user satisfaction. The analysis test is done by multiple linear regression test with the formula $Y = a + b_1X_1 + b_2X_2 + b_3X_3 +....+ b_nX_n$. To determine the regression analysis, the author uses the IBM SPSS Statistics 21 application as a tool.

3.3. Result Reliabiliy and Validity Analysis

To verify the dimensions and reliability of the construction study, the purification process, including factor analysis, the internal item-to-total correlation Consistency analysis (Cronbach alpha) was conducted in this study. For each Construction study, the validity test was first used to identify the construction dimension, To select a questionnaire item with a high factor load, and to compare this option Item with the theoretically suggested item. The correlation of the total corrected items, the Alpha coefficients, and the communalities were then assessed to identify internal consistency and construct reliability. Selection criteria are: (1) Total Correlation Total Correlation> 0.50, (2) Alpha Cronbach (α)> 0.7.

Table 6. Results of Reliability and Validity of the Final Survey

Item's	Cronbach's alpha
Reliability (R, 1-4)	0,735
Flexibility (F, 1-2)	0,778
Integration (I, 1-3)	0,808
Accessbility (A, 1-4)	0,815
Response Time (RT, 1-4)	0,807
Accuracy (AC, 1-6)	0,814

Format (FO, 1-6)	0,842
Completeness (CO, 1-4)	0,681
Service Reliability (SR, 1-4)	0,660
Service Support (SS, 1-3)	0,719
User's Empathy (UE, 1-2)	0,664

Reliability test shows that all variables are considered reliable and used for reliability test criteria seen from Cronbach Alpha (α)> 0.7. It can be seen that each variable is> 0.7.

3.4. Regression Analysis

Table 7. Regression analysis if result for factors affecting user satisfaction **Coefficients**[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	1,147	,348		3,299	,001		
Reliability	-,033	,085	-,036	-,383	,702	,529	1,889
Flexibility	,051	,060	,075	,848	,398	,587	1,703
Integration	-,051	,069	-,073	-,746	,457	,479	2,087
Accessbility	,085	,116	,093	,728	,468	,284	3,527
Response Time	-,021	,122	-,021	-,169	,866	,295	3,393
Accuracy	-,316	,136	-,296	-2,320	,022	,282	3,544
Format	,338	,164	,326	2,059	,042	,184	5,442
Completeness	,245	,118	,241	2,085	,039	,343	2,915
Service Reliability	,099	,069	,131	1,440	,153	,552	1,810
Service Support	-,026	,096	-,026	-,271	,787	,501	1,996
User's Empathy	,372	,090	,392	4,145	,000	,515	1,941

This study uses the significance level of p-val <0.05, the level of significance to express the risk of error rate to reject the hypothesis. The value at p-val = 0.05 means there is 95% (1 - 0.05 = 0.95) possibly true. By looking at the normal distribution table, it is found for p-val = 0.05, the value of t is = 1.96. Table 7 shows that in this study there are 4 variables as accepted criteria because the value of p-val shows <0.05. Among them are Accuracy, Format, Completeness and User's Empathy.

4. Conclusion

Based on the results of the two analyzes done in the previous chapter, it can be concluded that there is a significant connection between Expert assumptions and user satisfaction. Where in the AHP analysis, the Expert revealed that the System Dimension consisting of the criteria (Reliability, Flexibility, Integration, Accessibility and Response Time) become the main priority that must be considered and improved its performance, then on the regression analysis obtained from the calculation of respondents data (user elearning) Dimensional system has a p-val value above 0.05 (> 0.05) which means that user satisfaction is still minimal for this dimension. In the AHP calculation, the Service dimension lies in the last priority of the expert's concern. Likewise with the assumption of elearning users based on the results of regression analysis, elearning users have felt very satisfied with the Service dimension shown with p-val value below 0.05 (<0.05) that is User's Empathy with p-val value of 0.000.

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