Evaluating the usability of academic information system websites

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Abstract: The purpose of this study was to assess the relationship between web usability dimensions in academic information system websites. Dimensions that used in this study such as consistency, simplicity, reliability, responsiveness, quality of information, web design, assurance, readability, navigation, satisfactions and web usability. A questionnaire was designed and distributed to 150 students of a university in Indonesia. Partial Least Square (PLS) was used to assess the developed model. SmartPLS 2.0 (M3) was applied based on path modeling. The results showed that quality of information, responsiveness, and satisfaction had positive significant impact on web usability. Furthermore, the findings also revealed there were six significant relationships between usability dimensions. The results of this study provide a feedback for developer to develop more usable websites of academic information system and for researchers to better have a better understanding about relationship between web usability dimensions.

Key words: Web usability; Academic information system; Partial least square (PLS)

1. Introduction

Along with the very rapidly development of science and technology, makes the flow of communication and information sharing between individuals becomes very easy (Sengel and Oncu, 2010). Included also in college, the utilization's aspect of Information and Communication Technology (ICT) in education is a must to be done, in order to improve the quality of education results. Implementation of information technology would support the effectiveness of service and become a force for the institution compared to other universities (Indrayanti, 2013).

Implementation of ICT applied in a university in the form of the development of an integrated information system called "i-Gracias. Information management system developed for both academic and non-academic-based website. This information system is also used by many users, such as faculty members, students, parents, and administrative staff.

Based on the results of interviews about the most frequently used services, found that academic module still needs to be analyzed further. To determine the user's perception of the academic information system "i-Gracias", the preliminary survey has been done with 89 respondents from among the faculty and students. Preliminary survey results indicate that there are still many users who feel confused about how to use the system. It is characterized by 44% of respondents stated that they have difficulties when using academic information systems i-Gracias. In addition, the results of the preliminary survey also obtained complaint data and disruption experienced by the user during use i-Gracias, such as a complicated navigation, mismatch information, difficulties to access the system, often lost connection, and down of the system at high traffic time.

An efficient and easy to use information system design would increase awareness of the potential users of the information system (Ballard, 2010). Therefore, it is necessary to identify important factors in the implementation of the information system. There are two factors that influence the use of information systems; they are usability and accessibility (Petrie and Kheir, 2007). IEEE defines usability as a convenience for the user to operate, prepare input and interpret the output of the system. ISO 9241-11 defines usability as the ability of the software to be understood, learned, used and attractive to the user when used under certain conditions (Nagpal, et al., 2013). While the accessibility related to the ease of individual to access the entire site so that the information can be obtained with a complete and well understanding (Petrie and Kheir, 2007).

Along with the increased use of information systems, the research relating to usability has been carried out. Research carried out related to the development of usability evaluation model on the university website (Manzoor and Hussain, 2013; Nagpal et al., 2013). Kumar (2011) conducted an evaluation of campus information systems at the Fiji National University. Hasan (2014) revealed that the content and navigation is a factor to consider in the

website designing according to the characteristics of university students.

To evaluate the usability aspect of the website, it is necessary to develop theoretical models about website usability. After developing the research model, the next step is to identify and measure the attributes of website usability (Lee and Kozar, 2012). Some objects research on usability, including e-commerce websites (Lee and Koubek, 2010; Li and Li, 2011; Lee and Kozar, 2012; Tanjung and Dhewanto, 2014) and University websites (Kumar, 2011; Manzoor and Hussain, 2013; Nagpal et al., 2013; Hasan, 2014). However, in previous studies, academic information systems used for operational needs has never been used as a research object.

From these explanations seem that there is still a gap of research to be used for testing the usability of academic information system. In this study, usability models will be developed for academic information system. This study aims to provide empirical evidence of the relationship between the dimensions of usability for academic information system. The expected results are improvement recommendations to develop academic information system that is easier to use and provide a better understanding of the relationship between the dimensions of usability.

2. Research models and hypothesis

Based on the results of study literature, development of research model use UWIS model (Usability of Web-based Information System) developed by Oztekin et al. (2009) as a model references. UWIS model developed by Oztekin et al. (2009) has combined the concept of measuring the quality and reusability. This model adapts the Servqual model as a basis consisting of the dimensions of Quality of Information, Reliability, Responsiveness, Assurance, and Integration of Communication. Then model development is done by adding the Navigation dimension of Usability Heuristic Models and Controllability dimension of ISO 9241-10 model. Both of this dimensions described the usability aspects in the display interface design.

But the deficiency of the UWIS model is not entered satisfaction dimension. According to the rules of ISO 9241-10, the dimension of satisfaction is one of the requirements of site usability (Oztekin, et al., 2009). In addition, this UWIS model pays less attention to interface design aspects of the website. Based on Kozar and Lee (2012) there are other usability dimensions need to be considered, they are Simplicity, Readability, and Consistency. This entire dimension focuses on designing display of the information system website. Refers to the research conducted by Manzoor and Hussain (2012) another usability dimension needs to be considered is Web Design. This dimension relates to the completeness of features / components as well as easy access to the user website. Usability models used in this study are shown in Fig 1.
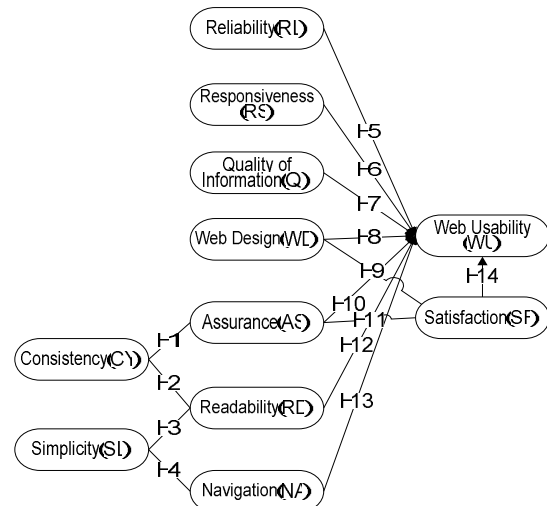

Fig. 1: Research model

Based on research model (see in Fig. 1), there were 14 hypotheses that formulated in this study:

- Hypothesis 1: There is a significant relationship between consistency and assurance.
- Hypothesis 2: There is a significant relationship between consistency and readability.
- Hypothesis 3: There is a significant relationship between simplicity and readability.
- Hypothesis 4: There is a significant relationship between simplicity and navigation.
- Hypothesis 5: There is a significant influence of reliability on web usability.
- Hypothesis 6: There is a significant influence of responsiveness on web usability.
- Hypothesis 7: There is a significant influence of information quality on web usability.
- Hypothesis 8: There is a significant influence of web design on web usability.
- Hypothesis 9: There is a significant relationship between web design and satisfaction.
- Hypothesis 10: There is a significant influence of assurance on web usability.
- Hypothesis 11: There is a significant relationship between assurance and satisfaction.
- Hypothesis 12: There is a significant influence of readability on web usability.
- Hypothesis 13: There is a significant influence of navigation on web usability.
- Hypothesis 14: There is a significant influence of satisfaction on web usability.

3. Methods

This study will extend their findings and specifically measure on the relationship between usability dimensions in academic information system case. The variables involved will be used to develop a model, which will be quantitatively tested and validated. Partial Least Squares (PLS) path modeling was used as it is a robust Structured Equation Modeling technique which is flexible in handling.

The sample of the present study consists of students of a university in Indonesia. A total of 150

questionnaires were distributed to potential respondents and only 138 questionnaires were used for analysis (response rate 92 percent). To assess the model developed (see Fig. 1) the study used the SmartPLS 2.0 (M3) which is based on path modeling and then the bootstrapping (Hair, et al., 2011; Kwong and Wong, 2013) with 5000 re-samples were used to generate the standard error of the estimate and t-values.

4. Data analysis and results

The Partial Least Square (PLS) was used in analyzing the data. This method was chosen because not only because the researcher model involves more than one dependent variable but also because it has the ability to describe the relationship between variables simultaneously. There are two stages of data processing in PLS consist of assessment of measurement model and evaluation of

the structural model. Assessment of measurement model was conduct based on convergent validity, discriminant validity and composite reliability, while evaluation of structural model based on R-square and path coefficient.

4.1. Assessment of measurement model

In this stage, it is essential to establish the reliability and validity of the latent variables to complete the assessment of measurement model. As shown in Table I, most item loadings were closed to or exceeded 0.7. It showed that all indicators were reliable. To fulfill the internal consistency reliability test the composite reliability should be 0.7 or higher (Ghozali, 2008; Hair et al., 2011). Based on the result shown in Table II, most of the latent variables accomplish the composite reliability criteria.

Table 1: Outer loadings

	AS	CY	NA	QI	RD	RL	RS	SF	SL	WD	WU
AS1	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AS2	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AS3	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AS4	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CY1	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CY2	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CY3	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NA3	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NA4	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
QI1	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00
QI2	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00
QI4	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RD1	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.00	0.00
RD2	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00
RD3	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.00	0.00
RL1	0.00	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.00
RL2	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00
RS1	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00	0.00	0.00
RS3	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00
SF1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.00	0.00
SF2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00
SL1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00	0.00
SL4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00
WD1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	0.00
WD2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00
WU1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85
WU2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82

Table 2: Results of measurement model

	AVE	Composite Reliability	R Square	Cronbachs Alpha	Communality	Redundancy
AS	0.518	0.811	0.132	0.693	0.518	0.068
CY	0.580	0.803	0.000	0.630	0.580	0.000
NA	0.648	0.786	0.077	0.457	0.648	0.050
QI	0.563	0.794	0.000	0.611	0.563	0.000
RD	0.573	0.800	0.282	0.635	0.573	0.126
RL	0.624	0.768	0.000	0.399	0.624	0.000
RS	0.616	0.761	0.000	0.387	0.616	0.000
SF	0.752	0.858	0.220	0.672	0.752	0.117
SL	0.581	0.734	0.000	0.284	0.581	0.000
WD	0.569	0.707	0.000	0.305	0.569	0.000
WU	0.697	0.821	0.432	0.566	0.697	0.012

Table 3: Discriminant validity of constructs

	AS	CY	NA	QI	RD	RL	RS	SF	SL	WD	WU
AS	1.00										
CY	0.36	1.00									
NA	0.44	0.12	1.00								
QI	0.57	0.36	0.38	1.00							
RD	0.50	0.47	0.31	0.49	1.00						
RL	0.49	0.27	0.26	0.44	0.49	1.00					
RS	0.37	0.26	0.44	0.36	0.22	0.30	1.00				
SF	0.40	0.38	0.33	0.48	0.49	0.49	0.34	1.00			
SL	0.43	0.13	0.28	0.37	0.31	0.33	0.30	0.24	1.00		
WD	0.09	0.11	0.16	0.20	0.14	0.14	0.15	0.28	0.20	1.00	
WU	0.39	0.28	0.36	0.48	0.36	0.43	0.41	0.56	0.32	0.30	1.00

Thus, the study ensured convergent validity because all Average Variance Extracted (AVEs) exceeded 0.5 (see Table I). In addition, the square root of the AVE was tested against the inter correlations of the construct with the other constructs in the model to ensure discriminant validity and all the square root of the AVE exceeded the correlations with other variables (Table III). Thus, the measurement model was considered satisfactory with the evidence of adequate reliability, convergent validity, and discriminant validity. Next the study proceeded to test the hypotheses generated for this research.

4.2. Evaluation of the structural model

Bootstrapping procedure was used to generate T-statistics for significance testing of the structural model. The analysis of inner model could be determined by R2 score. R-square (R2) showed the level of variability for each endogenous variable was determined by other variables. Based on the results on Table II, it could be seen that:

- Consistency could only explain 13,2% of the variance in assurance .
- Simplicity and consistency together could explain 28, 2% variance in readability.
- Simplicity could only explain 7, 7% variance in navigation.
- Web design and assurance could explain 22% variance in satisfaction.
- Variance in web usability (WU) 43, 2% could be explained by other variables, such as reliability, responsiveness, quality of information, web

design, assurance, readability, navigation, and satisfaction.

This result showed that the many variables have a significant influence on web usability. But we couldn't identify which variables had a significant impact on web usability to prove the research hypothesis. The hypothesis testing was conducted by evaluating the path coefficient for the inner model. Using a two-tailed t-test with a significance level of 5%, the path coefficient will be significant if the "T-statistics" is larger than 1.96. Results of hypothesis testing could be seen in Table IV and Fig 2.
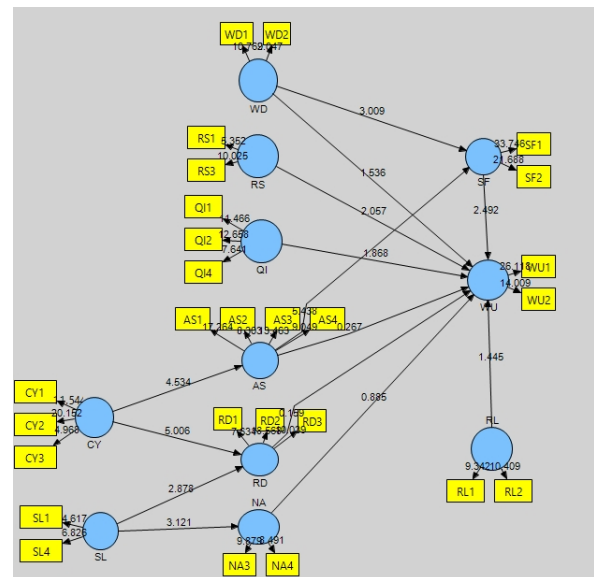

Fig. 2: Results of path analysis

Table 4: Results of hypothesis testing

Hypo-thesis	Latent Variables	Original Sample (O)	Std Error (STERR)	T Statistics (|O/STERR|)	Supported
H1	CY -> AS	0.36	0.08	4.61*	Yes
H2	CY -> RD	0.44	0.09	5.05*	Yes
H3	SL -> RD	0.25	0.09	2.92*	Yes
H4	SL -> NA	0.28	0.09	3.22*	Yes
H5	RL -> WU	0.13	0.09	1.47	No
H6	RS -> WU	0.15	0.07	2.10*	Yes
H7	QI -> WU	0.16	0.09	1.86*	Yes
H8	WD -> WU	0.14	0.09	1.49	No
H9	WD -> SF	0.25	0.08	3.05*	Yes
H10	AS -> WU	0.02	0.08	0.27	No
H11	AS -> SF	0.38	0.07	5.40*	Yes
H12	RD -> WU	-0.02	0.11	0.16	No
H13	NA -> WU	0.07	0.08	0.89	No
H14	SF -> WU	0.30	0.12	2.49*	Yes

* Significance at 0.05

The results have indicated that three dimensions, consist of quality of information (QI), responsiveness (RS), and satisfaction (SF), were found to have positive significant impact on web usability (WU). Hence thus, H6, H7, and H14 were supported. Other result shows that there were a significant relationship between usability dimensions, such as consistency and assurance (H1), consistency and readability (H2), simplicity and readability (H3), simplicity and navigation (H4), web design and satisfaction (H9), and also assurance and satisfaction (H11).

5. Discussions

This study aimed to evaluate the relationship between the dimensions of usability. In addition, this study also identified factors that influence website usability. Based on structural model evaluation results of hypothesis testing, there are 9 relationships that has the most significant relationship.

Consistency (CI) has a significant relationship to Assurance (USA). This shows that the consistency of the component layout of each page and the menu in between pages in the website will make user to use the website easier. This condition supports understanding the information and learns the accessed website (Lee and Kozar, 2012). Academic information system i-Gracias accessible at URL http://igracias.telkomuniversity.ac.id has 22 main menus. The link average for each menu on the i-Gracias is 3-4 nested links to reach the link. Considering a lot of menus provided in academic information system i-Gracias, it is important to pay more attention for layout of the menu to make user easier to access it.

In addition, the Consistency dimension (CI) has a significant influence on Readability (RD). This shows the strong influence of the consistency of the display aspect design in order to ease of reading the information provided in the display page on the website. Moreover, it should also be paid more attention for well-organized display, and readable and understandable information. Things that can affect the display of information consist of the size of the text font and color contrast between text and background colors (Manzoor and Hussain, 2012).

Besides consistency (CI), simplicity (SL) also significantly associated with the readability (RD). Simplicity is defined as the simplification of the display content and functionality of a website. The simpler view the content, the information provided will be more easily understood. In addition, the simplicity (SI) also has a significant relationship with the navigation dimensions (NA). Based on the results of preliminary survey, obtained responses from users that the navigation is too complicated to use academic information system i-Gracias, so that there are 44% of respondents in the preliminary survey had difficulty in using academic information systems i-Gracias. If the navigations in academic information

systems i-Gracias easy to use, then the user experience will be growing. This resulted in a much easier process and system access time will be much faster, because the information requirements can be easily find by the users. However, Lee and Kozar (2012) mentions that the simplification of the display structure still needs to considering the completeness of the required content in the website.

The results showed that the dimension of assurance (AS) and web design (WD) has a significant relationship with satisfaction (SF). This condition indicates that the features and component completeness and ease to access and ease to use the website will be very influential to website user satisfaction. Website users who feel comfortable in using the website would be willing to use the website back. This becomes very important, considering the academic information system i-Gracias made to support the operational needs of the academic campus. The level of use of information systems is very high, therefore it is important for users of both lecturers, students or other parties can be easy and convenient to use this web-based information system.

This study obtain a finding that there are three-dimensional effects on web usability (WU), they are responsiveness (RS), quality of information (QI) and satisfaction (SF). Responsiveness dimensions (RS) has a significant positive effect on web usability (WU). Availability of information and facilities that support the user experience while using the website. Results of Lee and Kozar (2012) research showed that users want the support media that can help in the information search. Based on the results of the preliminary survey some users are not aware of any feature to search for information as well as the need for guidance in using the information system.

Quality of Information dimension (QI) has a significant influence on web usability (WU). This condition indicates that the information aspects are important to be considered in academic information systems i-Gracias. Information system development is done to simplify the data management and integration of information. However, in practice it turns out still found some errors or mismatches information. Therefore, it is important to pay more attention for information management system in order to be beneficial for all parties. It also stages to obtain the information expected to be more concise and simple, so that the information access time becomes faster.

The last result of this research that web usability dimension (WU) is significantly influenced by the satisfaction dimension (SF). These results indicate that the level of satisfaction with the use of academic information system will greatly affect the usability assessment. As we know that one of the indicators in measuring the usability of a system is user satisfaction while using the system. Therefore, it is necessary to improve the quality of service of academic information systems i-Gracias order to improve the user experience and satisfaction of

users of the system, so that users will be willing to use the academic information system i-Gracias further.

Based on the results of usability evaluation can be proposed some improvements related to academic information system i-Gracias. Proposed improvements that can be given are improving navigation, display, making the user's website guidelines, and considering the suitability of the information.

The main thing that needs to be fixed for the navigation aspect is the number of nested links and naming menu. For links that are frequently accessed by the user should be placed on the main menu, so that users do not experience difficulty in searching for links. Moreover, it should also be noted the number of nested link in the menu. The existence of some concerns regarding the access link information is difficult to find, because the naming menu does not match the expectations, it will be difficult for users to find information.

To improve interface design and display, the thing to note is the use of font size. In the early pages of news and information i-Gracias font size used is too small. It is difficult for the reader to reads the news and information. To facilitate the delivery and search of information should be done sorting and grouping of data.

Guidelines should not only be given in the form of a PDF that can be downloaded, but also provided guidance in the form of Help, flowchart or tutorial related to the use of features and applications that are most frequently used. In addition, it is important to do the socialization of academic information system for new users, or when additional features in website.

6. Conclusion

The purpose of this study was to assess the relationship between usability dimensions in academic information system case. The findings reveal that three dimensions consist of quality of information (QI), responsiveness (RS), and satisfaction (SF), were found to have positive significant impact on web usability (WU). Furthermore, the results also uncover that there were six significant relationship between usability dimensions, such as consistency and assurance; consistency and readability; simplicity and readability; simplicity and navigation; web design and satisfaction; and also assurance and satisfaction. The results of this study provide a feedback for developer to develop more usable websites of academic information system and for researchers to better have a better understanding about relationship between web usability dimensions.

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