Development of Website Usability Instrument Based on Experts Review

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Abstract. Nowadays, website is use widely all over a world for medium of communication for information or services and usability principles was implementing in web environment and not for software only. Organization use website to market their product and services. There are many methods to evaluate the website such as heuristic evaluation, testing, survey and many more. This study is aiming to develop the questionnaire for measure website in context of usability. The instrument consist 9 constructs and 60 item of questionnaire. Content validity by experts is used as one of methodology to validate the instrument. Five experts are involved in this study. The result shows that from 60 item of instrument, 9 item need to remove based on experts review.

1 Introduction

There are many factor or characteristic for determine the quality of website or software [1] [2]. Usability is the most factor in website or software quality. Many researcher adapted software usability in website usability. There are many definitions or terms about usability. Human Computer Interaction (HCI) is about designing computer systems that support people so that they can carry out activities productively and safely. In HCI term, usability is more to usable user interface or in other word to make system easy to learn and easy to use [3]. Based on ISO 9241 – 11 in HCI field, usability is defined as the "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" [4][1]. Refer to the definition on ISO 9241 – 11, the criteria of usability are effectiveness, efficiency and satisfaction. This definition has 3 components that can divide such as "specified users", "achieve specified goals" and "specified context to use". This definition is more clear what usability is mean and many researchers use this definition [3]. There are several usability model such as Eason Model (1984), Shackel Model (1991), Nielsen Model (1993), ISO 9241-11(1998), ISO 9126 (2001) and QUIM model (2006) [2]. There are

a few approaches to evaluate website usability such as heuristic evaluation, survey, focus group, card sorting and other more approach that can be implementing.

2 Website Measurement Approach

There are many approaches for usability evaluation such as testing, inspection, inquiry, analytical modeling and simulation [5]. All the evaluation methods have one common characteristic that is dependent on user judgment.

Usability lab testing is focused on the experience and comment from users that used the web sites or in scenario-based environment [6]. Usability lab testing only involves a small group of user [7]. It record the user behavior and cognitive processes to see what user actually feel and how user use the web site. There are a few approaches in usability testing such as: Thinking aloud protocol, Co-discovery learning, Performance measurement, Coaching method, Remote testing, Eye-tracking and many more.

Usability inspection is generic name for a set of methods based on having evaluators inspect or examine usability-related aspects of a user interface [8]. Requires usability specialists or software developers, users and other professional to examine or judge either the prototype or each element of interface follows established usability principles. Cognitive Walkthrough, Heuristic Evaluation, Feature Inspection, Pluralistic Walkthrough and Guideline Checklist are a few example of usability inspection.

Usability inquiry involves experts to get information about the user requirement for the system by communicating with them or observed them while users are using the system. A few approach in usability inquiry such as Field observation, Interviews, Focus groups, Proactive field study, Logging actual use and Surveys. Table 1 below shows the advantage and disadvantage between usability measurements

Table 1. Advantage and disadvantage between usability measurements

Categories	Method	Advantages	Disadvantage
Inquiry	Individual interview	• enable to learn about things that cannot be directly observed • allow for probing	• Time consuming • expensive
Inquiry	Focus group	• Can provide speedy results • Structured data can be collected • Planning can enable in-depth discussion	• Recruitment can be expensive, time consuming • Controlled settings may affect behaviours • Data can be difficult to analyse
Analytical modelling	Task Analysis	• Help attain understanding of processes and resources to complete each task • Helps make	• Require time and resources • Skills required for efficient analysis of the

		recommendation regarding changes to the system	task
Analytical modelling	Card sorting	• Easy to conduct • Identifies items that are likely to be difficult to categorize • Understanding of how real users categorize	• Takes time to complete • Can be expensive to hire participants
Inspection	Prototype	• Issues in design can be identified • Complete functionality can the tested	• Time consuming to create • More expensive to develop
Inquiry	Survey	• Quick and cost effective • Gather a lot of data • Can be administered on large population	• Time consuming to collect data
Inspection	Heuristic Evaluation	• Easy to perform; cheap • No planning required • Able to find many problems (both major and minor problems) • Not time-consuming (no users involved)	• Focus on problems
Testing	Thinking Aloud	• Able to find why the problems occur • Small number of test users • Low time in relation to other evaluations methods • Direct interaction of the users with the transactional web application	• Time consuming • Can be expensive to hire participants
Testing	Formal Evaluation	• Objective method • Provide substantive depth in quantitative data	• Time consuming
Testing	Query Technique	• Provide qualitative and quantitative data • Simple and cheap	• Time consuming

2.1 Questionnaire

Questionnaires in survey are the most frequently used tools for usability evaluation. It more easy and cheap than other approach for gathering user feedback [9]. The researcher can choose either made it online survey or paper-and-pencil instruments. There has three type of questionnaire, pre-test questionnaire, post-task questionnaire and post-test questionnaire. A pre-test questionnaire is to get more information about participants before they start working with the product. A post-task questionnaire is to get immediate feedback after each scenario. A post-test questionnaire is to get feedback about the whole experience. Many users can involve in this evaluation. There are many types of standard post-test questionnaires based on

the specific field and criteria such as SUS (System Usability Scale), QUIS (Questionnaire for User Interface Satisfaction)[10], CSUQ (Computer System Usability Questionnaire), Words (adapted from Microsoft's Product Reaction Cards) [11] and other more. All this questionnaire are widely used and readily available. Basically questionnaires are evaluations that access the perception from the user's point of view of the web sites.

3 Methodology

This study implement post-test questionnaire. The survey instrument used in this study is a 60 item questionnaires. Content validity by experts is conducted to see the validity based on experts view before conduct the pilot study or actual study. Content validity means to the degree that the instrument covers the content that it is supposed to measure[12][13]. Content validity is important to see the view of experts on the important of construct and item in the questionnaire [14]. About 20 experts were invited thru email to participate in this study. The experts were choose based on their experience and participated in website or usability. Only 5 experts give a feedback. Five experts for content validity are sufficient because the recommendation is to select at least 3 experts for evaluation [15][13][14]. The instrument has undergone review process by 5 experts in website and usability studies. Table 2 is information about experts that involved in this study. The experts are selected based on their experience in website and usability field. This process required about a month to gather all the experts present the result of content validity.

Table 2. Advantage and disadvantage between usability measurements

Expert	Experience in Teaching / Industry	Position, Qualification	Participation / Involvement in the field of website or usability
Expert 1	10-14 years	Senior Lecturer, Doctor of Philosophy (PhD)	5-9 years
Expert 2	20-24 years	Associate Prof, Doctor of Philosophy (PhD)	20-24 years
Expert 3	10–14years	Senior Lecturer, (Masters)	5 – 9 years
Expert 4	20-24 years	Professor, (Masters)	20-24 years
Expert 5	5-9 years	Executive, Degree	5-9 years

3.1 Initial Instrument

Questionnaire from the Computer System Usability Questionnaire (CSUQ) and WAMMI were adapted and also include a few questions from previous studies that refer to the constructs [16]–[19]. The questionnaire instrument is known as Questionnaire for Website Usability (QWU). Table 3 below are the list of 60 item in the initial questionnaire. The instruments divide into 9 parts from 60 item that reflect to 9 contructs that are used in this study which is *Effectiveness, Efficiency,*

Satisfaction, Learnability, Accessibility, Navigation, Content and Interface/design for Independent Variable (IV) factors and *Intention to Use* as a Dependent Variable (DV).

The first part of the questionnaire contains a demographic profile of expert, including gender, age, current position, education level, experince in teaching or in industry and involment in website or usability. A five-point Likert-type scale ranging from (1) ‘‘Extremely unimportant”; (2) ‘‘Unimportant”; (3) “Less Important”; (4) “Important” and (5) “Extremely Important” was used to evaluate the 60 item of the questionnaires. This instruments also include suggestion or comment in each of contructs.

Table 3. The initial list of questionnaire instrument

Construct	Code	Item	Reference
Efficiency	EY1	When I use the Web site there is very little waiting time between my actions and the Web site’s response.	[20]
	EY2	It is easy to find the information that I need	CSUQ
	EY3	I am able to efficiently complete my work using this website	CSUQ
	EY4	I can effectively complete my work using this website	CSUQ
	EY5	I believe I became productive quickly using this website	CSUQ
Effectiveness	EV1	On this website, it is simple to accomplish the task I want to accomplish.	[5]
	EV2	I find it easy to get this Web site to do what I want it to do	[21]
	EV3	I am able to complete my work quickly using this website	CSUQ
	EV4	It was simple to use this website	CSUQ
	EV5	The information is effective in helping me complete the tasks and scenarios	CSUQ
Satisfaction	S1	I feel comfortable using this website	CSUQ
	S2	This website has all the functions and capabilities I expect it to have	CSUQ
	S3	I am satisfied with how easy it is to use this web site	CSUQ
	S4	I am satisfied with this web site	CSUQ
Learnability	L1	Learning to operate the Web site is easy for me.	[20]
	L2	I find the Web site easy to use.	[5]
	L3	All the material is written in a way that is easy to understand.	WAMMI
	L4	Using this website for the first time is easy.	WAMMI
	L5	The contents provided by the website are easily understood	[16]
	L6	The website is designed for easy understanding	[16]
	L7	The information provided by the website is easy to understand	CSUQ
	L8	It was easy to learn to use this website	CSUQ
Accessibility	AC1	The website offers customization.	[5]
	AC2	It was easy to move from one page to another	[19]
	AC3	The text on the website is easy to read	[20]
	AC4	It takes time to open the web page or download the web	

		page	
	AC5	It has a accessibility function on the web site (can resize text, change the background colour etc)	
	AC6	The website's wording is clear and easy to understand	[16]
	AC7	The website uses colors and structures that are easy on the eyes	[16]
	AC8	The pages download quickly on this website.	[5]
Navigation	N1	I can easily navigate this site.	[17]
	N2	This site provides good navigation facilities to information content.	[17]
	N3	I like the way hyperlinks are embedded in this site's design	[22]
	N4	I feel in control when I'm using this web site	WAMMI
	N5	I get what I expect when I click on things on this website.	WAMMI
	N6	The navigation and labels on this Web site were clear.	[18]
	N7	Links are consistent and easy to identify	[23]
	N8	The website provides multiple search features (e.g: search engine,menu bar,go-back-and-forward button, etc) to obtain the target information	[16]
	N9	It was easy to move from one page to another	[19]
Content	C1	I trust the Web site to keep my personal information safe.	[20]
	C2	I can trust this website.	[17]
	C3	I trust the information presented on this website.	[17]
	C4	The information provided at this site is sufficient.	[17]
	C5	The website adequately meets my information needs.	[17]
	C6	I find the information on this site to be well organized	[17]
	C7	I feel this Web site clearly stated its purpose for using the site	[18]
	C8	The website provides up-to-date information	[16]
	C9	The information (such as online help, online messages, and other documentation) provided with this website is clear	CSUQ
	C10	The organization of information on the website pages is clear	CSUQ
Interface / design	ID1	The website repeats the same structure, components and overall look across pages.	[16]
	ID2	Web pages in the website are consistently designed	[16]
	ID3	This web site is presented in an attractive way. (i.e. colors, images, layout etc)	WAMMI; [17]
	ID4	The pages on this website are very attractive.	WAMMI; [17]
	ID5	The layout of pages made tasks easier.	[18]
	ID6	The interface of this web site is pleasant	CSUQ
	ID7	I like using the interface of this web site	CSUQ
Intention to reuse	ITU1	I intend to use this website again	[19]
	ITU2	I would be willing to visit this website again	[18]
	ITU3	I feel this website reflects most current trend(s) and provides nice design for the site visit	[18]
	ITU4	I will reuse this website again	[19]

4 Feedback from experts

Based on the results shown in table 4, 9 items from 60 items in the questionnaire instrument have a low result of the feedback from experts review. The 9 items need to remove from the instruments are EY4, EY5, AC4, N4, C1, C2, C3, C7 and ITU4. The results are based on the mean value that the item need to have 3.5 and above to consider important to the constructs in the questionnaire. Besides that, each item selected and consider important if 4 experts give more than 3. This called universal agreement. So most of the experts need to give mark 3 or above to consider the item is important. The construct that involve in elimination of item are *efficiency, accessibility, navigation, content and intention to use*. All 9 items do not achieve the two scenarios.

For efficiency, there are 2 items did not achieve the 2 scenarios that need to consider as important for website usability. EY4 - *I can effectively complete my work using this website* that has mean value 3.2 and EY5 – *I believe I became productive quickly using this website* has mean value 3.

AC4 is in accessibility construct. AC4 - *It takes time to open the web page or download the web page* has mean value 3.2. The statement for this item is in negative statement. Some of the experts did not agree with the negative statement because the entire items in this instrument are in a positive statement. The item also has a some meaning with AC8. AC8 - *The pages download quickly on this website.*

Item N4 in navigation has mean value 3.2. N4 - *I feel in control when I'm using this web site.* This item is about control. The experts did not agree that the item is important in this instrument.

The C1, C2 and C3 in the content construct are more on trust. C1 - *I trust the Web site to keep my personal information safe*, C2 - *I can trust this website* and C3 - *I trust the information presented on this website*. The mean value for C1, C2 and C3 are 2.4, 3.0 and 3. Most of the experts do not agree that trust is an important element when evaluate the website university. It is because website for university is trusted website. So did not need to evaluate on trust element for the content in the website. For C7 - *I feel this Web site clearly stated its purpose for using the site* has mean value 3.2. The experts did not agree that the item is important in the instrument. The higher education institution or university website are clearly stated the purpose and function the website.

ITU4 is in Intention to Use construct has mean value 3. 4. ITU4 - *I will reuse this website again.* Some of the experts did not agree the wording of reuse. Only 3 experts that gave scale 3.0 and above.

After analyzing the data using SPSS software in this phase, 51 items are remaining in the questionnaire instrument.

Table 4. The result from experts review

Code	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	mean	mode	median	sd
EY1	5	5	4	5	4	4.6	5	5	0.548
EY2	5	5	5	2	4	4.2	5	5	1.304
EY3	5	4	2	5	4	4	5	4	1.225
EY4	4	5	2	1	**4**	3.2	4	4	1.643
EY5	4	4	2	1	4	3.0	4	4	1.414
EV1	4	4	3	4	4	3.8	4	4	0.447
EV2	5	5	3	1	4	3.6	5	4	1.673
EV3	4	4	3	1	5	3.4	4	4	1.517
EV4	5	5	4	1	4	3.8	5	4	1.643
EV5	5	5	3	5	4	4.4	5	5	0.894
S1	3	5	3	5	4	4.0	3	4	1.000
S2	4	4	4	5	4	4.2	4	4	0.447
S3	4	5	5	5	4	4.6	5	5	0.548
S4	4	4	5	5	4	4.4	4	4	0.548
L1	5	4	4	4	4	4.2	4	4	0.447
L2	4	5	5	1	4	3.8	4	4	1.643
L3	4	5	4	4	4	4.2	4	4	0.447
L4	5	5	4	1	4	3.8	5	4	1.643
L5	5	5	4	5	4	4.6	5	5	0.548
L6	5	5	3	5	5	4.6	5	5	0.894
L7	5	5	3	3	4	4.0	5	4	1.000
L8	5	5	5	1	4	4.0	5	5	1.732
AC1	3	4	5	1	5	3.6	5	4	1.673
AC2	5	5	4	1	4	3.8	5	4	1.643
AC3	5	5	4	4	4	4.4	4	4	0.548
AC4	1	5	4	4	2	3.2	4	4	1.643
AC5	3	4	4	4	5	4.0	4	4	0.707
AC6	5	4	2	3	4	3.6	4	4	1.140
AC7	5	5	4	1	4	3.8	5	4	1.643
AC8	5	5	4	4	4	4.4	4	4	0.548
N1	5	4	5	4	4	4.4	4	4	0.548
N2	5	5	3	4	4	4.2	5	4	0.837
N3	4	4	2	4	4	3.6	4	4	0.894
N4	2	5	2	3	4	3.2	2	3	1.304
N5	5	5	4	4	4	4.4	4	4	0.548
N6	5	5	4	4	5	4.6	5	5	0.548
N7	5	5	3	4	5	4.4	5	5	0.894
N8	5	4	2	4	5	4.0	5	4	1.225
N9	5	5	4	4	4	4.4	4	4	0.548
C1	5	2	2	1	2	2.4	2	2	1.517
C2	5	2	5	1	2	3.0	5	2	1.871
C3	5	3	4	1	2	3.0	N/A	3	1.581
C4	5	4	3	4	4	4.0	4	4	0.707
C5	5	4	4	5	4	4.4	4	4	0.548
C6	5	5	3	5	5	4.6	5	5	0.894

C7	5	4	2	1	4	3.2	4	4	1.643
C8	5	5	5	4	4	4.6	5	5	0.548
C9	4	5	5	4	4	4.4	4	4	0.548
C10	4	5	2	4	4	3.8	4	4	1.095
ID1	4	4	5	4	4	4.2	4	4	0.447
ID2	5	5	5	5	4	4.8	5	5	0.447
ID3	5	5	4	5	4	4.6	5	5	0.548
ID4	5	5	3	4	4	4.2	5	4	0.837
ID5	5	5	4	5	4	4.6	5	5	0.548
ID6	5	5	4	4	4	4.4	4	4	0.548
ID7	5	4	3	4	4	4.0	4	4	0.707
ITU1	5	4	5	5	4	4.6	5	5	0.548
ITU2	5	4	5	5	4	4.6	5	5	0.548
ITU3	5	4	3	4	4	4.0	4	4	0.707
ITU4	5	4	2	4	2	3.4	4	4	1.342

5 Future Recommendation

Content validity is an important method in developing the questionnaire instrument. The approach can ensure the construct validity and give confidence to the researcher about the instrument before distributing it for pilot study or actual study. Content validity by experts is one of the approach in validate the instruments. The feedback and comments from the experts give the researcher to see the instruments in the width direction and focusing to the specific element to evaluate the website usability.

Besides that, the finding could contribute to support the construct validity of the instrument. Because sometimes as researchers, we miss some of the important elements and that's why we need a second opinion from experts to make the instrument more usable. Content validity measures the comprehensiveness and representation of the content on a scale.

To ensure the instrument are trusted and valid, the next phase is the instrument will evaluate by focus group which are students as a real respondents. In this phase, researchers will involve direct with the focus group to gather the feedback from them. This approach also involves interviews with the focus group. After doing content validity with the focus group, then pilot study will conduct before the final instrument distribute to the actual study. The instruments will have a few stages of evaluation to ensure the item and construct covers the content and suppose to measure. The analysis based on the experts review contributes to the body of knowledge in term of evaluation of the website usability focusing on higher education institution or university website.

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References

1. A. Fernandez, E. Insfran, and S. Abrahão, "Usability evaluation methods for the web: A systematic mapping study," *Inf. Softw. Technol.*, vol. 53, no. 8, pp. 789–817, Aug. 2011.
2. S. K. Dubey, A. Rana, and Mridu, "Analytical Comparison of Usability Measurement Methods," vol. 39, no. 15, pp. 11–18, 2012.
3. L. Leventhal and J. Barnes, *Usability Engineering Process, Products, and Examples*. Pearson Prentice Hall, 2008.
4. M. De Marsico and S. Levialdi, "Evaluating web sites: exploiting user's expectations," *Int. J. Hum. Comput. Stud.*, vol. 60, no. 3, pp. 381–416, Mar. 2004.
5. J. Wang and S. Senecal, "Measuring Perceived Website Usability," *J. Internet Commer.*, vol. 6, no. 4, pp. 97–112, 2008.
6. S. Batra and R. R. Bishu, "Web Usability and Evaluation : Issues and Concerns," *Hum. Factors*, pp. 243–249, 2007.
7. A. Ai-wabil and R. Ai-khalifa, "A Framework for Integrating Usability Evaluations Methods : The Mawhiba Web Portal Case Study," *Methodology*, 2009.
8. J. Nielsen and R. L.Mack, *Usability Inspection Methods*. John Wiley & Sons,Inc, 1994.
9. S. Elling, L. Lentz, and M. De Jong, "Website Evaluation Questionnaire : Development of a Research-Based Tool," *Evaluation*, pp. 293–304, 2007.
10. A. Madan and S. K. Dubey, "Usability Evaluation Methods : A Literature Review," vol. 4, no. 02, pp. 590–599, 2012.
11. T. S. Tullis and J. N. Stetson, "A Comparison of Questionnaires for Assessing Website Usability," pp. 1–12, 2004.
12. F. Yaghmale, "Content validity and its estimation," *J. Med. Educ.*, vol. 3, pp. 25–27, 2003.
13. S. N. Haynes, D. C. S. Richard, and E. S. Kubany, "Content Validity in Psychological Assessment : A Functional Approach to Concepts and Methods Introduction to Content Validity," *Psychol. Assess.*, vol. 7, no. 3, pp. 238–247, 1995.
14. E. Delgado-rico, H. Carretero-dios, and W. Ruch, "Content validity evidences in test development :," *Int. J. Clin. Heal. Psychol.*, vol. 12, pp. 449–459, 2012.
15. L. Crocker, A. Maria Llabre, and M. D. Miller, "The Generalizability of Content Validity Ratings," *J. Educ. Meas.*, vol. 25, no. 4, pp. 287–299, 1988.
16. Y. Lee and K. a. Kozar, "Understanding of website usability: Specifying and measuring constructs and their relationships," *Decis. Support Syst.*, vol. 52, no. 2, pp. 450–463, Jan. 2012.
17. D. Cyr, "Website design, trust and culture: An eight country investigation," *Electron. Commer. Res. Appl.*, vol. 12, no. 6, pp. 373–385, Nov. 2013.
18. C. E. Downing and C. Liu, "Assessing Web Site Usability in Retail Electronic Commerce," *2011 IEEE 35th Annu. Comput. Softw. Appl. Conf.*, pp. 144–151, Jul. 2011.
19. S. Poelmans, P. Wessa, K. Milis, E. Bloemen, and C. Doom, "Usability and Acceptance of E-Learning in Statistics Education , Based on the Compendium Platform," *Inf. Syst. J.*, pp. 1–10, 2008.
20. E. Loiacono, R. Watson, and D. Goodhue, "WebQual: An Instrument for Consumer Evaluation of Web Sites," *Int. J. Electron. Commer.*, vol. 11, no. 3, pp. 51–87, Apr. 2007.
21. J. W. Palmer, "Web site usability , design , and performance metrics," 2002.
22. X. Zhang, K. Keeling, and R. Pavur, "Information quality of commericial web site home pages: an explorative analysis," in *ICIS '00: Proceedings of the twenty first international conference on Information systems*, 2000, pp. 164–175.
23. P. J. Meyers, "25 Point Website Usability Checklist," 2009. [Online]. Available: http://drpete.co/blog/25-point-website-usability-checklist. [Accessed: 20-Apr-2015].