

Assessing Usability Elements For A Website of Higher Education Website

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Abstract. Nowadays, humans are inseparable with the internet. Most of the desired information can be obtained easily by just at fingertips. Web sites are widely used in daily life no matter for work or for entertainment, and connect with others in their social life. Usability is one of the quality factors that determine the successfulness of a website. This study reviews existing usability standards and model from previous study. Based on the study, many previous works only mentioned the attribute in usability in general and did not include sub-attribute. There also did not much published works in usability guidelines that comes up with metric for easy measurement especially focusing for website. This study identifies the major aspects in website usability and forming a useful guideline that include accessibility in website usability unlike earlier work which separate between usability and accessibility.

Keywords: website usability, QUIM Model, quantitative research, higher education web site.

1 Introduction

Web sites are important nowadays in the globalized competition. Almost all the organization using the website to share information and also as a medium of communication because it not only cost effective but also save time. Everyday new web sites are publishing in the internet and it has been growing at an exponential rate. A website is a collection of web page. It is a medium of communication (Aaberge et al., 2004). It represents the brand of the organization and provides first impression about the organization to user [2]. If it is not well presented or poor in web design, it will make user away and give poor reputation to the organization [3].

There are many types of website that not only provide information but also delivery services such as online learning or e-learning, e-commerce, e-government and many more. In Malaysia there are many website that deliver services such MyEG, MyCoID, e-filling and other more. The internet also creates a new business environment. Nowadays, user can buy many items such as clothing, shoes, books, computer

and many more only by staying at home and it can save time, money and energy. Users only need a computer and connection to internet. There are a few examples of popular web sites in Malaysia such as ebay.com.my, zalora.com.my, mudah.my, lelong.com.my and many more. The advantages using website as medium to perform services are it is more easier, cheaper and faster to publish information on the internet. Therefore all information or the content in the website must be accurate and have a good design to meet the user requirement and the most important usable. The quality of the website can be assessed in many ways and must be ensured to give a good perspective to user so he or she will come again to the web site. Usability has assumed the importance in terms of satisfying website user's need and expectations [6]. The aim of the research is to identify the major element in website usability, thereby forming a useful guideline to measure the website usability that has major element with metric for easy measurement.

2 Literature Review

Website evaluation is determining the quality of the web site. There are many factors or characteristics to determine the quality of website or software [7] [8]. Usability is among the most important factor in website or software quality. There are many quality models that have usability such as McCall's Quality Model, Boehm's Quality Model, ISO 9126 Quality Model, FURPS Quality Model, Dromey's Quality Model and QUIM Quality Model [8]. Many researchers adapted software usability in website usability. There are several usability models such as Eason Model (1984), Shackel Model (1991), Nielsen Model (1993), ISO 9241-11(1998), ISO 9126 (2001) and QUIM model (2006) [9][10][8].

Lack of usability elements degrade user satisfaction and result in complaints, site abandonment, loss of current or future business, bad press, bad decisions, lost time and poor productivity. A well designed user interface is a critical factor. User will have stronger intentions to use and revisit the web portal if they found the web portal is easy to use and reduce their cognitive load beside it is more useful that gives the information what they want [11]. The perception of usability also influenced by user characteristics such as gender, age, educational level and technology skills. Besides that, cultural differences also give effect to design layout, use of colour and animation and information content [12].

In Human Computer Interaction (HCI) term, usability is more to usable user interface or in other words to make system easy to learn and easy to use [13]. 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” [14][7]. Refer to the definition on ISO 9241 – 11, the criteria of usability are effectiveness, efficiency and satisfaction. It focuses on human interaction perspective for software product standard. This definition has 3 components that can be divided such as “specified users”, “achieve specified goals” and “specified context to use”. Other definition on usability is defined as “how well and how easily a user, without formal training can interact with an information system of a web site” [15]. Usability definitions are arranged in table 1 below.

Table 1 : Usability definitions

Sources	Definitions
Shackel (1991)	The capability in human functional terms to be used easily and effectively by the specified range of users, give specified training and user support, to fulfill the specified range of tasks, within the specified range of scenarios.
Bevan (1991)	The usability of a product as a function of the particular user or class of users being studied, the task they perform, and environment in which they work.
ISO 9241-11 (1998)	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.
Dumas (1999)	Usability is observed when “the people who use the product can do so quickly and easily to accomplish their own tasks.”
ISO 9126 (2001)	The capability of the software product to enable specified users to achieve specified goals with effectiveness, productivity, safety, and satisfaction in specified contexts of use.
ISO 9126-1 (2001)	The capability of the software product to be understood, learned, operated, attractive to the user, and compliant to standards/guidelines, when used under specific conditions.
Benbunan-Fich (2001)	How well and how easily a user, without formal training can interact with an information system of a web site

According to the research by Karahoca et al.(2010), the element in usability are learnability and efficiency, aesthetics and navigation, content and functionality, accuracy and consistency, technical adequacy, help and documentation and error removal. [17] also use effectiveness, efficiency, satisfaction and learnability as attributes for usability model for digital library. She also grouped usability into two groups that are inherent usability and apparent usability. Inherent usability means to make product easy to understand, easy to learn, efficient to use, less erroneous and pleasure. Apparent usability is more related to visual impression of the interface [17]. Information layout, server response time, time to load, download time and speed are the most important variables for web page design [18]. In the context of web site, usability that has specified users, specified goals and specified context of use. That mean user has its own role, own objective and task to use the website in environment and domain in actual usage. Website usability can define as a quality attribute that assesses how easy user interfaces to use. The definition can divide in two ways that look to interface or final product based on its attributes and other hand refer to methods for improving ease of use during the design process or the approach used to conduct usability research [19] [20].

Table 2 : Usability **Attribute** from the previous studies by researchers which are show that there are a few major attribute that are important used in usability such as effectiveness, efficiency, learnability and satisfaction. Some of the study refer some terminology in different word such as easy to learn is learnability or speed of performance refer to efficiency. The table also shown that only a few study that include accessibility as element in usability.

Table 2 : Usability Attribute

Authors / Reference	Attributes
Shakel (1981) / [17]	Effectiveness, ease of use
Shackel (1986,1991)/[21] [17]	Effectiveness,Satisfaction/attitude,Learnability/time to learn,Flexibility
Booth (1989)/ [17]	usefulness, effectiveness, learnability, attitude
Dumas & Redish (1993)/ [17]	functionally correct, efficient to use, easy to learn, easy to remember, error tolerant, and subjectively pleasing
Hix & Hartson (1993) /[17]	initial performance, long-term performance, learnability, retainability, advanced feature usage, first impression, and long-term user satisfaction
Nielsen (1993,1996) /[21]	Efficiency, Learnability, Memorability, Errors, Satisfaction
Dix (1993)/[21]	Learnability/time to learn,Flexibility,Robustness
ISO (1994) /[17]	effectiveness, efficiency, satisfaction
Preece (1994)/ [21]	Effectiveness, Efficiency/speed of performance, Satisfaction/attitude, Safety/Error, Learnability/time to learn
Rubin (1994)	Usefulness, Effectiveness, Learnability, attitude
Guillemette (1995)/ [17]	effectively used by target users to perform tasks
Gluck (1997)/ [17]	useableness, usefulness
Shneiderman(1998)/ [21]	Efficiency/speed of performance, Satisfaction/attitude ,Memorability/Retention over time, Safety/Error, Learnability/time to learn
ISO 9241 (1998)/[21]	Effectiveness, Efficiency/speed of performance, Satisfaction/attitude
Clairmont et al. (1999)/ [17]	successfully learn and use a product to achieve a goal
Kengeri et al. (1999)/ [17]	effectiveness, likeability, learnability, usefulness
ISO 9126 (2001)/[21]	Effectiveness, Satisfaction/attitude,Productivity, , Safety/Error
Kim (2002)/ [17]	interface effectiveness
Brinck et al. (2002)/ [17]	perform tasks quickly and easily
Oulanov & Pajarillo (2002) /[17]	affect, efficiency, control, helpfulness, adaptability
Peerce et. al (2002)	Effective, efficient, safety, utility, easy to learn, easy to remember
Furtado et al. (2003)/ [17]	ease of use and learning
Quesenbery (2003,2004)/ [22]	Effectiveness, efficiency, engaging, error to tolerant, easy to learn
Dix, Finally, Abowd, & Beale (2004)/ [22]	Learnability: Predictability, Synthesizability, Familiarity, Generalizability, and Consistency Flexibility: Dialog Initiative, Multi-threading, Task Migratability, Substitutivity, and Customizability Robustness: Observability, Recoverability, Responsiveness, and Task Conformance
Schaffer (2004)	Speed, Accuracy, Training, Satisfaction, safety
Tarafdar & Zhang (2005a) / [22]	Information Content, Ease of Navigation, Ease of Use, Access Speed, Customization and Personalization, Security, and Accessibility
Coursaris and Kim (2006) /[22]	effectiveness, efficiency , satisfaction, learnability, flexibility, attitude, oper-

	ability, errors, memorability, accessibility, accountability
Seffah, Donyaee, Kline, & Padda (2006) / [22]	Efficiency, Effectiveness, Productivity, Satisfaction, Learnability, Safety, Trustfulness, Accessibility, Universality, and Usefulness

3 Research Methodology and Hypotheses

QUIM or Quality in Use Integrated Measurement is developed by Ahmed Seffah et al in 2006. QUIM is a consolidated model for usability measurement and metrics. It combines various standard and model such as ISO 9241 and ISO 9126 and unified into a single consolidated, hierarchical model. It outlines methods for establishing quality requirements as well as identifying, implementing, analyzing, and validating both process and product quality metrics. This model appropriate for novice user that have little knowledge of usability and can be applied by usability experts and non-experts. QUIM model consists of 10 factors and subdivided into 26 criteria or measurable criteria, and finally into specific metrics consists 127 specific metrics. The 10 factors consists Efficiency, Effectiveness, Satisfaction, Learnability, Productivity, Safety, Trustfulness, Accessibility, Usefulness and Universality. The model is used to measure the actual use of working software and identifying the problem. In QUIM model associates factors with criteria and metrics in a clear and consistent way [23]. QUIM model are used in this study as the basic and modified it focusing on website usability. In this study, only five(5) attribute are used from QUIM model that are Effectiveness, Efficiency, Learnability, Satisfaction and also include Accessibility. The five(5) usability attributes are selected because it that has been use frequently in the previous models and previous study as in table 2 [24]. This study used QUIM model because it also include Accessibility to measure usability. Only a few study include Accessibility as shown in table 2. Accessibility also important attribute because it refer how easy the website to access and it give impact to website usability. The attributes also focus on website usability as the main attributes. Each attribute has it own characteristics. The sub criteria are presented in table 3. The attributes are directly measurable at least one specific characteristic.

Table 3 : Relations between usability attribute and characteristics for web site

Attribute Characteristics	Efficiency	Effectiveness	Satisfaction	Learnability	Accessibility
Time behaviour	√				
Resource utilization	√				
Attractiveness			√		
Likeability			√		
Flexibility		√	√		√
Minimal action	√		√	√	√
Minimal memory load	√		√	√	√
Operability	√		√	√	
User guidance			√	√	√

Consistency		√		√	√
Self-descriptiveness				√	√
Feedback	√	√			
Accuracy		√			
Completeness		√			
Readability					√
Controllability					√
Navigability	√	√			√
Simplicity				√	√
Familiarity				√	
Loading time	√				√
Effectiveness of help web site		√			
Effectiveness of the user documentation		√			
Response time	√				√
Completeness of description		√		√	√

The proposed research predicts that Effectiveness, Efficiency, Learnability, Accessibility and Satisfaction are positively associated with the usability of Universiti Malaysia Pahang (UMP) website. The following are the brief description for each attribute :

- Efficiency – the way a website supports user in carrying out their tasks and capability of the website to enable users to expend appropriate amounts of resources in relation to the effectiveness achieved in a specified context of use.
- Effectiveness – refer to how good a website is at doing what it is supposed to do and the capability of the website to enable users to achieve specified tasks with accuracy and completeness
- Learnability – refer to how easy a website is to learn to use. It is the capability of the website to enable users to feel that they can productively use the website right away and then quickly learn other new (for them) functionalities.
- Accessibility - refer to how easy the user to access the website and the capability of website to be used in terms of response time to each task that perform by user and by users with some type of disability (e.g., visual, hearing, psychomotor).
- Satisfaction – refer to subjective response how users comfort to use the website and their positive attitude after use the web site.

The main purpose of this research is to test the proposed research for website usability. Only five attributes use in this model including accessibility because to see the website usability in general opinion and not focus on specific area. Higher education web sites are chosen to evaluate the proposed usability model. Evaluating website usability is of significant importance to the success of higher education websites [25]. Higher education web sites often contain important information about academic re-

sources, campus events, and administrative policies. These sites also provide information on college services such as the college library, campus bookstore, and course registration system. As college websites take on significant and increasingly important roles, it is imperative that these sites be user-friendly.

For the instrument for this study, questionnaire from Computer System Usability Questionnaire (CSUQ) [26] were adapted and also include a few question that refer to the item constructs that used in [27] [28] [29]. CSUQ- was developed by James Lewis at IBM in 1995. It uses 19 questions on a 7-point scale of “Strongly Disagree” to “Strongly Agree” plus N/A. CSUQ are satisfaction questionnaires and all statement in CSUQ are worded positively. CSUQ is suitable for usability study in a non-laboratory setting.

The first part of the research contains demographic profile of respondents including gender, age, internet usage duration and internet experience. The questionnaire assesses website usability by asking participants to compare their expectations against what they actually find on the web site. The items of the constructs such as Effectiveness, Efficiency, Learnability, Accessibility and Satisfaction are used.

A five-point Likert-type scale ranging from (1) “strongly disagree” to (5) “strongly agree” was used to answer the questions in the 32 item of the questionnaire. Since some items in the questionnaire were developed adapted from CSUQ and a few are additional, a pre-test was required. Students and staff from TATI University College (TATIUC) were listed to complete the preliminary questionnaire of 32 items. A pilot test was conducted to test the research model and questionnaire.

Pilot Study

A pilot study was conducted to identify consistency of the questions and an understanding of the respondents to the questionnaire. 82 respondents were involved in this pilot study. Table 4 shows the activity and survey agenda.

Table 4: Survey Agenda

Activity	Session Duration
Phase I : Introduction to Research Experimentation	
Description on Research Procedures	5 minutes
Phase II : Experimental Implementation	
Respondents explore the website and solve the given task	30 minutes
Filling out Post-Experiment Questionnaire	30 minutes
Summary, Question and Answer (non formal)	15 minutes

4 Experimentation and Results Analysis

In this section, the descriptive statistics, regression analysis results to test the research hypothesis are presented. Data analysis is conducted using SPSS 18.0.

Descriptive statistics

The major descriptive statistics are presented in table 5 below and discussed accordingly.

Table 5 : Descriptive Statistics about Demographic

Characteristics		N	%
Gender	Male	42	51.2
	Female	40	48.8
Age	18 – 24	77	93.9
	25 – 31	3	3.7
	32 – 38	-	-
	39 – 45	2	2.4
	46 – 49	-	-
	Above 50	-	-
Employment	Government employees	2	2.4
	Private sector employees	4	4.9
	Self - employed	-	-
	Student	76	92.7
Highest educational qualification	Secondary school	1	1.2
	Certificate	1	1.2
	Diploma	76	92.7
	Degree	3	3.7
	Master	1	1.2
	Doctor of Philosophy (Phd)	-	-
Internet experience	Less than 1 year	5	6.1
	1 – 3 years	30	36.6
	4 – 6 years	18	22.0
	More than 6 years	29	35.4
Frequency of using internet per day / how often do you use internet per day?	Never	2	2.4
	Less than 4 hours	18	22.0
	5 – 9 hours	27	32.9
	10 – 14 hours	9	11.0
	15 – 19 hours	15	18.3
	20 – 24 hours	11	13.4
Do you have visited this website before this?	Yes	39	47.6
	No	43	52.4

As presented in Table 5 above, most of the participants were male (51.2%) and female (48.8%). More than 92.7% of the participants are student and other 7.3% are employees in government sector (2.4%) and private sector (4.9%). Since most of the participants are student, about 93.9% were below 24 years of age. These also reflect to the education level, more than 92.7% of participants are diploma student from TATIUC. 36.6 % has internet experience between 1 – 3 years and 35.4% has internet experience more than 6 years. Most of the participant spend 5 to 9 hours (32.9%) using internet per day. More than 50% of the participants never visit the web site.

Hypothesis Testing

Five attributes were used for proposed research in context of website usability such as Efficiency, Effectiveness, Learnability, Accessibility and Satisfaction. Below are the hypothesis for all proposed attributes:

H1: Efficiency will have a significant and positive effect on website usability.

H2: Effectiveness will have a significant and positive effect on website usability.

H3: Learnability will have a significant and positive effect on website usability.

H4: Accessibility will have a significant and positive effect on website usability.

H5: Satisfaction will have a significant and positive effect on website usability.

To examine the measurement scale reliability and initial construct validity of the website usability measurement scale. First, descriptive statistics and initial reliability estimates were computed using Cronbach's alpha. To test either the questionnaire reliable to use or not to provide the formal questionnaire to respondents and analyze the responses statistically, so measuring reliability is conducted. By measuring the scale's reliability based on the value of Cronbach's Alpha, the value must be more than 0.5 ($p > 0.5$) [30]. Cronbach's alpha, the variance extracted from all constructs and the descriptive statistics of mean and standard deviations of all items in the questionnaire. The average variance extracted, which is used to measure the discriminated validity of each construct is only accepted when it is more than 0.5 ($p > 0.5$).

Reliability of attribute in the questionnaire using Cronbach's Alpha is 0.939 using 22 items. Cronbach's Alpha was used to check reliability of each attribute. For the whole questionnaire for the survey is reliable because the results is above .5. All attributes in the questionnaire is more than 0.5. Table 6 shows the Cronbach's Alpha for each attribute.

Table 6 : Cronbach's Alpha for each attribute reliability

Attribute	Cronbach's Alpha
Efficiency	.746
Effectiveness	.820
Learnability	.640
Accessibility	.781
Satisfaction	.818

The model tested by regression analysis. A regression analysis was performed to test the relationship between perceived usability and attitude toward the web site. Linear regression analysis model were run to test the element in the model. Based on the table 7, the R Square is .649. R Square (R^2) is a measure of amount of variability in one variable that is shared by the other [31]. The hypothesis accepted because the result more than 0,05 ($p,0,05$). All the attributes are significant and positive effect to website usability.

Table 7 : Linear regression model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.806 ^a	.649	.626	.599

a. Predictors: (Constant), Satisfaction, Efficiency, Learnability, Accessibility, Effectiveness

The significance level of the correlation coefficient of the model shown in table 8 demonstrates that all five (5) hypotheses derived from the research were supported. All attributes; efficiency, effectiveness, learnability, accessibility and satisfaction are important to website usability. Table 8 shown the correlations using Spearman. Spearman’s correlation coefficient is used to measures the strength of association between two variables and nonparametric. This study used Spearman’s correlation because it more appropriate for measurements taken from ordinal scales [31][32].

These shown all the attribute are supported the hypothesis because the result of correlation is significant at the level 0.01 (P<0.01). Learnability (.719) is the highest value in correlation. Effectiveness is .695, Accessibility is .624, Satisfaction is .600 and Efficiency is .493 in Spearman’s Correlation. This shown that all attribute give affect to website usability including Accessibility (.624) that evaluates whether information can be accessed efficiently and easily. All correlation variables indicated a positive relationship with each other and significant at a 0.01 level. This study was proposed that usability could be modelled with the variables derived from the QUIM model that include Accessibility distinct from other model [9][10][8].

Table 8 : Spearman’s Correlations

Correlations			Usability
Spearman's rho	Efficiency	Correlation Coefficient	.493**
		Sig. (2-tailed)	.000
		N	82
	Effectiveness	Correlation Coefficient	.695**
		Sig. (2-tailed)	.000
		N	82
	Learnability	Correlation Coefficient	.719**
		Sig. (2-tailed)	.000
		N	82
	Accessibility	Correlation Coefficient	.624**
		Sig. (2-tailed)	.000
		N	82
	Satisfaction	Correlation Coefficient	.600**
		Sig. (2-tailed)	.000
		N	82

** . Correlation is significant at the 0.01 level (2-tailed).

5 Conclusion

This study examined the measurement of website usability using the proposed research hypothesis that has Effectiveness, Efficiency, Learnability, Accessibility and Satisfaction as attribute in website usability. The intention of this study is to propose a few attributes in QUIM model and adapted it in proposed research to see either it can be applied and give effect in the context of website usability. The outcome of the study seems to fulfill the objectives when it clearly identified that all attributes are important and have positively significant affects the website usability. Learnability is most significant determinant that directly affects usability. Accessibility also gives impact to usability. If the website is difficult to access like the page takes time to load, it also influences to user satisfaction and effect the usability of the web site. Although the respondents are not students or staffs from UMP, but the result from the study proved that UMP website is very useable to everyone and have the entire element that needed in website usability. Usability is not only for user reactions to a user interface but also for as measurement of usability. There are several attribute to get the complete usability picture such as effectiveness (can people complete their tasks?) and efficiency (how long do people take?). Beside that, user satisfaction is just one important dimension of usability. ISO 9241 definition of usability state that this 3 attribute to measures usability.

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