

Applying Website Usability Testing Techniques to Promote E-services

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Abstract

In this competitive world, websites are considered to be a key aspect of any organization's competitiveness. In addition to visual esthetics, usability of a website is a strong determinant for user's satisfaction and pleasure. However, lack of appropriate techniques and attributes for measuring usability may constrain the usefulness of a website. To address this issue, we conduct a statistical study to evaluate the usability levels of e-learning and e-training websites based on human (user) perception. The questionnaire is implemented as user based tool, visitors of a website can use it to evaluate the usability of the websites. The results showed that according to the students' point view the personalization has the first important criterion for the use of the e-learning websites, while according to experts' point view the accessibility has the first important criterion for the use of the e-learning websites. Also the result indicated that the experienced respondents have demonstrated satisfaction over the usability attributes of e-learning websites they accessed for their learning purposes; while inexperienced students have expressed their perception on the importance of the usability attributes for accessing e-learning websites. When combining and comparing both findings, based on the outcomes it is evident that, all the attributes yielded satisfaction and were felt important.

Keywords: Usability, e-learning, usability attributes, user based tool, user perception.

1. Introduction

The Internet is fast becoming an important new channel for businesses in many sectors, raising e-services as the emergent business paradigm in the industrialized world. E-services are comprised of all interactive services that are delivered on the Internet using advanced telecommunications, information, and multimedia technologies. E-services provide a

unique opportunity for businesses to offer new models for service design strategies and new service development [6]. Also the influence Internet in creating e-services has been revolutionary for providers and their customers. E-services quality (e-SQ) can define as "the extent to which a website facilitates efficient and effective shopping, purchasing and delivery" [4]. This definition makes it clear that the concept of e-SQ extends from the pre-purchase phase (ease of use, product information, ordering information, and personal information protection) to the post-purchase phase (delivery, customer support, fulfillment, and return policy).

Usability studies let product developers can understand interface and design errors before a product goes onto the market. By identifying these barriers early, developers have the opportunity to rectify them and save time and money, increases customer satisfaction and thereby increases sales and revenues.

Organizations and educational institutions are extensively investing in information technologies to develop e-learning software, e-learning authoring tools and e-learning management systems during the last two decades.

E-learning is one of the most significant recent developments in the IS industry. E-learning is commonly referred to the intentional use of networked information and communications technology in teaching and learning [9]. E-learning technology may make learning available to a wider audience and has the power to promote more equal access to learning for as large and diverse group as possible [8]. The interface of an e-learning website is considered as the entry point for the visiting learners whose

interactivity, learnability and sustainability totally rely on its layout, content, information and other attributes of the site. Evaluating the usability of e-learning applications is not a trivial task. The diversity of learners, technological advancements and radical changes in learning tasks (learner interaction with a learning/training environment) present significant challenges and render the possibility of defining the context of use of e-learning applications. Website usability opens the door for flourishing delivery of teaching and learning activities. Therefore, this study has been carried out to examine the corresponding influence of usability attributes of an e-learning website.

2. Related Works

Ali [3] developed a conceptual framework for measuring the quality aspects and criteria of m-learning. Furthermore, a software prototype application for smartphones to assess usability issues of m-learning applications has been designed and implemented. This prototype application is developed using Java language and the Android Software development Kit, such that the recommended guidelines of the proposed framework are maintained. A questionnaire survey was conducted at Western University with approximately 96 undergraduate software engineering students. Five identical smartphones are used to evaluate the developed prototype in terms of ease of use, user satisfaction, attractiveness and learnability. In this study the data was analyzed using Pearson and Spearman Correlation Coefficient Methods. The results reveal that the proposed framework can be used as a guideline to support forward and reverse engineering while developing mobile applications. Thowfeek et al [7] considered "Shackel's usability model presented in 1984" to examine the usability e-learning website among the final year undergraduate students of South Eastern University of Sri Lanka (SEUSL). They used 6 criteria: Content of the site, Easy navigation, Ease of use, Effectiveness, Learnability, Satisfaction. The sample includes both experienced and inexperienced users of e-learning websites. The findings reveal that experience and/or lack of experience of students do not carry much connotation in this study but confirmed that the usability attributes are vital for the natural and spontaneous interactions with e-learning web sites.

3. Objectives of the Study

The main objective of this research is to propose a websites usability testing technique to assess e-learning and e-training websites usability. The sub objectives are:

- Identify the criteria that used to evaluate e-learning websites.
- Build websites usability testing technique can be used to assess e-learning and e-training websites offer e-services to improve and promote e-services usages.

4. Research Methodology

The first step in the proposed methodology is defining the criteria that used to evaluate e-learning websites and designing the research tool, then collecting data from participants to be able to find out the usability ratio for the selected websites.

4.1 Research Tool

The research work is accomplished through designing a questionnaire to collect user's perspectives about the existence of usability criteria that affect the success of the websites. Questionnaire is widely accepted and recommended as a standard usability evaluation tool for evaluating usefulness of websites. Several studies have employed questionnaires as tools for assessing the website usability. Questionnaires must be carefully designed to yield valid information. Meticulous attention must be paid to ensure that individual questions are relevant, appropriate, intelligible, precise, and unbiased. The proposed questionnaire was developed based on extensive study of previous studies [1, 2, & 4]. It consists of two sections. The first section includes variables that are related to the demographic characteristics of the study sample. Whereas the second section contains criteria to measure the usability level of the selected websites. Nine criteria were used to test the website usability. These criteria are: Content, Navigation, Ease of use, Effectiveness, Learnability, Accessibility, Satisfaction, Community, and Personalization. Each criterion was represented by four closed-ended statements using five point likert scales as shown in Appendix.

4.2 Questionnaire Validation

To validate the proposed questionnaire, six professors and IS professionals from Qassim University in Saudi Arabia and Zagazig University in Egypt were participated to confirm it's free of language errors, credibility of the statements and questions understandability. According to experts' notes and recommendations, the questionnaire was modified.

4.3 Website Selection

Two websites were selected to conduct the study, these websites are:

- **E-learning websites:** Free-ed.net website (www.free-ed.net) was selected as an example of virtual university that offering thousands of free, online courses, study guides, e-textbooks, and other valuable learning resources.
- **E-training websites:** Coursera.org website (www.coursera.org) was selected as an example of training companies that offers massive open online courses in a variety of areas, including Humanities, Medicine, Biology, Social Sciences, Mathematics, Business, and Computer Science.

4.4 Sample Size

Two groups of participants were selected from Faculty of Computer and Informatics, Zagazig University, Egypt:

- Group I: 80 Final year students.
- Group II: 16 Web developers.

Awareness sessions were conducted to explain the objectives of the study and also to describe how to test the website and how to fill the proposed questionnaire. The participants were asked to visit the predefined websites and indicate the extent of their agreement or disagreement with each statement (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree).

4.5 Statistical Techniques

Validity and reliability are two fundamental elements in the evaluation of a measurement instrument such as questionnaires. Validity is concerned with the extent to which an

instrument measures what it is intended to measure, whereas reliability is concerned with the ability of an instrument to measure consistently. Statistical Package for Social Sciences (SPSS) version 20 was used to perform the statistical analysis required as follows:

- Cronbach's alpha, is the most widely used objective measure of reliability and it is used to measure the reliability of the questionnaire. Cronbach's alpha provides a measure of the internal consistency of a test or scale and is expressed as a number between 0 and 1 " > .9 : Excellent, > .8 : Good, > .7 : Acceptable, > .6 : Questionable, > .5: Poor and < .5 : Unacceptable" [3].
- Person's correlation coefficient was used to measure the correlation between results.

5. Analysis and Result

To get the accurate results of questionnaires, an independent descriptive analysis of e-learning and e-training websites was done to know participants perceptions, expectations, and opinions. Graphs and tables are used to show statistical data obtained from questionnaires.

5.1 Reliability and Validity of E-Learning website questionnaires

Two ways were used to calculate the reliability of E-learning questionnaires:

(a) Alpha-Cronbach's coefficients were calculated; this step showed that all items are reliable. The results also showed that intervention of items don't lead to reduce overall reliability coefficient of the questionnaire except two items (nq2, eouq4), it was found that the intervention of these two items reduce the overall reliability coefficient and they were deleted.

(b) Person's correlation coefficients were calculated; the results showed that all correlation coefficients are statistically significant ($p < 0.05$), which indicating to that the internal consistency and reliability of all items have been retained as shown in Table 1.

Table 1: Reliability and Validity of e-learning website questionnaires

question	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Cq1	.481	.879
Cq2	.294	.882
Cq3	.303	.882
Cq4	.332	.881
Nq1	.449	.879
Nq2	.114	.886
Nq3	.362	.881
Nq4	.397	.880
Eouq1	.443	.879
Eouq2	.300	.882
Eouq3	.402	.880
Eouq4	.157	.885
Wq1	.208	.883
Eq2	.533	.878
Eq3	.533	.878
Eq4	.533	.878
Lq1	.615	.877
Lq2	.336	.881
Lq3	.545	.878
Lq4	.563	.878
Aq1	.431	.880
Aq2	.437	.880
Aq3	.419	.880
Aq4	.419	.877
Sq1	.405	.882
Sq2	.541	.879
Coq1	.317	.881
Coq2	.471	.878
Coq3	.335	.881
Coq4	.482	.883
Pq1	.382	.877
Pq2	.258	.879
Pq3	.528	.877
Pq4	.467	.879

5.2 Conduction of Usability Test

5.2.1 Group I

A total of 80 students were selected from programs like information systems, information technology and computer science. According to participants' answer, the relative importance of the proposed criteria was calculated. The results showed that there are significant differences (at 0.01) between the criteria for the use of e-learning website as shown in Table 2.

Table 2: Repeated measures analysis of variance results when examining the differences between the criteria for the use of **E-learning** website (n=80)

Source of Variance	Sum of Squares	Df	Mean Square	F	Sig.
Between criteria	37.90	8	4.74	10.31	0.01
Error	290.34	632	0.46		

Table 3 shows the mean of the nine developed criteria of the two websites in descending order. Content is the highest criterion followed by navigation, whereas Personalization is the lowest one. The mean average of e-learning website usability is 3.567; it is equivalent to 71.3%. This means that the **usability** ratio of the selected websites is equal 71.3%.

To calculate the relative weight of each criterion, the differences between the average mean of 9 criteria and the average mean of the rest 8 criteria (except the criterion) were calculated. Criteria like Contents, Ease of use, Effectiveness, Learnability and Satisfaction have positive values. Contents, Effectiveness and Learnability have the highest values, whereas Personalization and Accessibility have the lowest values.

Table 3: The mean and the relative weight of the criteria of the E-learning websites (student)

No.	Criterion	Mean	Relative weight
1	Content	3.793	.029
2	Navigation	3.475	-.011
3	Ease of use	3.662	.012
4	Effectiveness	3.794	.028
5	Learnability	3.787	.027
6	Accessibility	3.306	-.032
7	Satisfaction	3.675	.014
8	Community	3.381	-.023
9	Personalization	3.230	-.043
Mean average		3.567	

The results showed that the most important criterion for e-learning websites usability is the Personalization as shown in Table 4. It also showed that the Accessibility is the second most important criterion followed by Community, Navigation; Ease of use, Satisfaction, Learnability, Effectiveness and finally Content is the least important criterion.

Table 4: The criteria of the E-learning website and their rank (students)

Criteria	Rank
Personalization	1
Accessibility	2
Community	3
Navigation	4
Ease of use	5
Satisfaction	6
Learnability	7
Effectiveness	8
Content	9

5.2.2 Group II

The second group contains 16 web developers (Teaching Assistants and Experts). The mean for each criterion and the mean average for all criteria are shown in Table 5. The mean average of e-learning website usability is equal to 3.05, and this average is equivalent to 61% of the total score. This means that the **usability** ratio is equal to 61%.

The relative weight for the nine criteria was calculated by measuring the differences between the average mean of 9 criteria and the average mean of the rest 8 criteria (except the criterion). The results showed that Criteria like Accessibility, Community and Personalization have the lowest values, whereas Learnability Contents and Satisfaction have positive values.

Table 5: The mean and the relative weight of the criteria of the E-learning websites (n=16)

No.	Criterion	Mean	Relative weight
1	Content	3.50	.06
2	Navigation	3.14	.01
3	Ease of use	3.30	.033
4	Effectiveness	3.25	.03
5	Learnability	3.81	.100
6	Accessibility	1.89	-.14
7	Satisfaction	3.47	.06
8	Community	2.08	-.12
9	Personalization	3.00	-.005
Mean average		3.05	

The results also showed that the most important criterion for e-learning websites usability is the Accessibility as shown in Table 6. It also showed that the Community is the second most important criterion followed by Personalization, Navigation, Effectiveness, Ease of use, Satisfaction, Content, and finally Learnability is the least important criterion.

Table 6: The criteria of the E-learning website and their rank (Experts)

Criteria	Rank
Accessibility	1
Community	2
Personalization	3
Navigation	4
Effectiveness	5
Ease of use	6
Satisfaction	7
Content	8
Learnability	9

5.3 Discussion

5.3.1 Comparison between the two groups

The results showed that there were statistically significant differences between the participants of the two groups concerning the relative importance due to there were different attitudes and experiences. In the first case study, the personalization has the first important criterion for the use of the e-learning websites, while in the second case study the accessibility has the first important criterion. The experts in group II agreed that the benefits of using websites is achieved when the accessibility is better within the site, whereas students agreed that the personalization has the top priority compared with the rest of other criteria to achieve their goal from using website as shown in Table 7 and Figure 1.

Table 7: the mean of the criteria of e-learning website for both students and experts

No	Criterion	Mean of Group I	Mean of Group II
1	Content	3.793	3.5
2	Navigation	3.475	3.14
3	Ease of use	3.662	3.3
4	Effectiveness	3.794	3.25
5	Learnability	3.787	3.81
6	Accessibility	3.306	1.89
7	Satisfaction	3.675	3.47
8	Community	3.381	2.08
9	Personalization	3.794	3.00
General average of Criteria		3.567	3.05

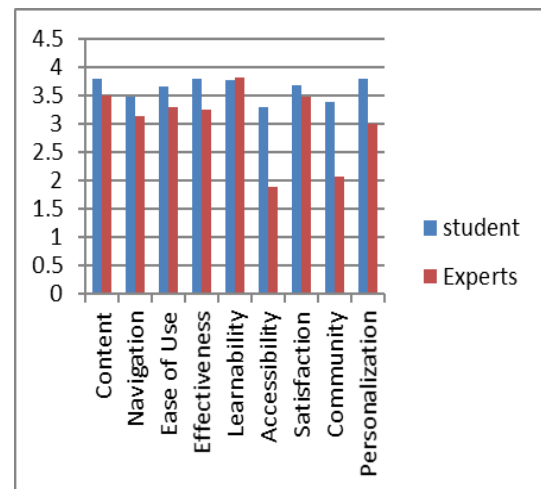


Fig.1: Comparison of Experienced and Inexperienced Respondents.

5.3.2 Comparison with previous study

The previous study that conducted by Thowfeek et al [7] evaluated the usability of e-learning websites under six criteria; these criteria are: Effectiveness, Learnability, Navigation, Ease of Use, Satisfaction, and Content of site. In present study, three new criteria were proposed; these criteria are: Accessibility, Community, and Personalization. The existence of these criteria effect on the visitors for this type of the websites compared with the previous study.

The results of Thowfeek et al [7] research indicated that some of the learners do not care about the appealing and pleasant design of the e-learning website. They focus more on acquiring information and knowledge, rather than enjoying the appearance of the website. In this study, the results indicated that the most important usability criteria for e-learning website testing is the website Accessibility and the existence of this criteria will increase the usefulness of this site as shown in Table 8.

Table 8: the mean of the criteria and their rank for the present and previous studies

Criteria	Mean		Rank	
	Present Study	Previous Study	Present Study	Previous Study
Content	3.793	3.87	9	3
Navigation	3.475	4.09	4	1
Ease of use	3.662	3.83	5	4
Effectiveness	3.794	3.93	8	2
Learnability	3.787	3.82	7	5
Accessibility	3.306	-	2	-
Satisfaction	3.675	3.57	6	6
Community	3.381	-	3	-
Personalization	3.794	-	1	-

6. Conclusions

The main objective of this research was not only the evaluation of the usability of user interface of an e-learning websites but also to analyze the importance of the evaluation criteria that support to learner's learning activities. This research is an effort to contribute in the area of usability evaluation of e-learning applications. The trend of using e-learning as learning and/or teaching tool is now rapidly expanding into education. The right design of website will avoid the technological problems and barriers. This research provides an empirical evidence for academic institutions and e-learning

organizations regarding to the relative importance of specific issues and criteria associated with e-learning websites.

The findings of the research emphasized several critical issues and criteria for e-learning websites usability testing. Potential factors affecting the usability of e-learning and e-training websites were identified in this work together with user preferences and attitudes.

Based on the results of the study, the following points can be concluded:

- 1- The specific nature of e- learning makes it vital for designers to consider certain usability attributes, like navigation, personalization and accessibility of a website, as early as possible in the development process.
- 2- Usability plays a key role in attracting and retaining users. Hence, institutions and organizations should pay much attention to website design to user friendly and rich in content, which give users trust and satisfaction.
- 3- The students took interest in Personalization despite of Content that can help them to view permission and can manage their private and public files easily.
- 4- The students accepted the results of websites usability tests with 71.34%, whereas experts agreed by 61%.
- 5- The result of this study and the previous study showed that learners do not much bother about the appealing focus more on acquiring information and knowledge, rather than enjoying the appearance of the website design.

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