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EVALUATION MODEL FOR THE USABILITY OF WEB-BASED LEARNING MANAGEMENT SYSTEMS WITH USER PROFILE

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ABSTRACT

The main purpose of Web-Based Educational Resources Management Systems (WERMSs) is to deliver knowledge, share information to help learners in their learning activities with an effective and efficient way by involving advanced electronic technologies. However, the Usability of these systems that is the degree of these systems to enable their users to use them effectively, efficiently and with satisfaction in a specified context of use, is one the challenges faced in the design of these systems. One of the main purposes of Human Computer Interaction (HCI) is using usability concept to create WERMSs that provide a relationship between user information and the WERMSs-content. Consequently, the next step is to evaluate the WERMSs will be based on usability metrics. This paper proposes a model for usability of WERMSs. The model introduced effectiveness, efficiency satisfaction, learnability, interactivity, consistency, motivation, learner's control, and user profile (age, gender, and level of experience) as the attributes that determine the usability of such systems. The model tested and verified using questionnaires and experiments. The results showed up that effectiveness, efficiency, satisfaction, learnability, motivation, interactivity, consistency, learner's control, and user profile (age, gender, and level of experience) affects the usability of WERMSs.

Keywords: web-based applications; e-learning management systems; human computer interaction; usability evaluation; e-learning;

1. INTRODUCTION

Usability of WERMSs is a great importance because their success depends on basic usability principles. This paper is an attempt to propose a model for usability to design interactive electronic educational system for the management of various educational resources and makes education the way closer to electronic education in the traditional way. And focused at the interest on lectures, books, announcements, contact with students and courses, and then proposed a model for usability of WERMSs and use this model to evaluate this system, also been exposed to some of the terminology used and displayed earlier studies in usability and usability evaluation of educational Management Systems. This paper is to introduce a model for usability and defining practical, fast and low-cost tools in order to analyze the usability of WERMSs according to this model. Kashif [1] present that the basic purpose of e-learning applications is to deliver knowledge, exchange information and help learners in their learning activities in an effective and efficient way by involving advanced electronic technologies. Usability of e-learning applications is of great importance because their success depends on basic usability principles. The criteria for determining the success can be defined by user satisfaction level after the user's interaction with the interface of the e-learning system [1]. Appropriate use of usability evaluation methods according to given scenarios is an important aspect [1]. Both end-users and usability experts participated in the study, during used different methods for usability evaluation of specific e-learning platform It's Learning [1].

2. RELATED WORKS

Learning Management Systems (LMSs) are web-based systems that enable teachers and students to share materials, to submit and return assignments and to communicate online [2]. LMS is software used to plan, implement and evaluate a specific learning process [3]. A Web-based application is any program that is accessed over a network connection using HTTP, rather than existing within a device's memory. Web-based applications often run inside a web browser. However, web-based applications also may be client-based, where a small part of the program is downloaded to a user's desktop, but processing is done over the internet on an external server [4].

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A web application or "web app" is a software program that runs on a web server. Unlike traditional desktop applications, which are launched by your operating system, web apps must be accessed through a web browser [5].

E-learning is the provision of training and educational programs through a variety of electronic media, including disks and the Internet in a manner synchronous or asynchronous, and the adoption of the principle of self-learning or teacher assistance learning [6]. E-learning can also define broadly as any use of Web and Internet technologies to create learning experience [7]. The most comprehensive definitions of e-learning were: "E-learning is the use of Web and Internet technologies to create experiences that educate our fellow human beings[7]." To expand on this definition and provide details, one could add that e-learning is facilitated and supported through the use of information and communications technology, e-learning can cover a spectrum of activities from supported learning, to blended learning (the combination of traditional and e-learning practices), to learning that is entirely online. Whatever the technology, however, learning is the vital element. Electronic Learning (or e-learning) is a kind of technology-supported education/learning (TSL) where the medium of instruction is through computer technology, particularly involving digital technologies [1]. The objectives of e-learning are to facilitate and assist people by delivering appropriate contents and services to fulfil user needs [1].

The basic purpose of E-learning applications is to deliver knowledge, share information and help learners in their learning activities in an effective and efficient way by involving advanced electronic technologies [8]. E-Learning system is special in its capability for co-operative and collaborative learning activities through asynchronous and synchronous communications to enhance learning effectiveness. It is also about meeting instructor and peer learners in the virtual community, solving problems together, and expecting feedbacks and interactions [8]. Web-Based Educational Systems (WBESs) offer interesting delivery mechanisms to teachers and learners [9]. Governance and accountability are key criteria to consider during the deployment of these WBESs. Assessment of WBESs also needs to be done to determine its effectiveness [9].

E-Learning Management Electronic System (EMES) is an electronic system that manages the distant learning process [8]. EMES aims to facilitate interaction between students and instructors. EMES also provides other services through this system such as instruction (the subject matter) for students via the Internet, lectures in distance through electronic classes, electronic discussions between instructors and students, posting assignments, helping students receive solutions and electronic feedback, providing tests for practices or class tests, and allowing distant students to post their projects and research in the presence of both the students and their instructors online.

Usability is a term which refers to the interaction of users with any software systems [10]. As per ISO and IEEE standards ISO 9241-11 usability is defined as "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" [11]. The definition of usability as per ISO/IEC 9126 standard is "Usability: a set of attributes that bear on the effort needed for use, and on the individual assessment of such use, by a stated or implied set of users" [12]. Another definition of the usability from ISO/IEC 9126-1 [13] "The capability of the software product to be understood learned, used and attractive to the user, when used under specified conditions". Nielsen [10] introduced Learnability, Efficiency, Memorability, Errors, and Satisfaction as attributes that determine the Usability. According to Ma [14], usability evaluation assesses the extent to which an interactive system is easy and pleasant to use.

Usability Evaluation is concerned with gathering information about the usability or potential usability of a system in order either to improve its interface or to assess it [15]. The aim is to determine the effectiveness or potential effectiveness of an interface in use or to provide a means of suggesting improvements to it [15]. Dix et al [16] suggested the main goals of evaluation. These are:

- To assess the extent of the system functionality;
- To assess the effect of the interface on the user; and
- To identify the specific problems with the system.

Usability of Educational Resources Management Systems: Usability plays an imperative role in the success of e-learning applications. If an e-learning system is not usable, the learner is forced to spend much more time trying to understand software functionality, rather than understanding the learning content [17]. Moreover, if the system interface is rigid, slow and unpleasant, people feel frustrated are likely to walk away and forget about using it [17]. Andrina et al. [18] pointed out that the Usability of pedagogical systems is a key feature in the pedagogy domain. According to, lack of an appropriate usable and user-centered interface design of different computerized educational systems decreases the interface's effectiveness and efficiency [18].

In research studies [15, 19, 20], it is pointed out that in order to evaluate the usability of the system and to determine usability problems, it is important to select appropriate usability evaluation method(s). Gray et al. [21] determine usability as efficiency, time, cost-effectiveness, ease of application, and expertise of evaluators. According to Melis et al. [22] to design an e-learning system which is more usable, basically involve two aspects:

- Technical usability, which involves methods for ensuring a trouble-free interaction with the system [22].
- Pedagogical usability, which aims at supporting the learning process. Both aspects of usability are intertwined and tap the user's cognitive resources [22].

The attributes that determine the usability of ERMS are effectiveness, efficiency, satisfaction, learnability, interactivity, consistency, motivation, and learner's control [23].

3. RESEARCH METHODOLOGY

In order to assess the usability educational resources management system, the study proposes a model based on ISO 41-11 [24] and others usability models such as effectiveness, efficiency satisfaction, learnability, interactivity, consistency, motivation, learner's control, and user profile. As shown in figure (1) the attributes of the model are:

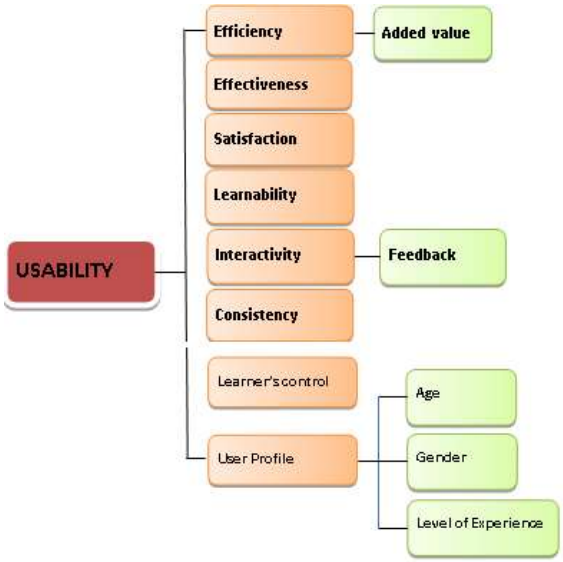

Figure. 1 Proposed model for the usability of educational resources management system

Efficiency: The system should be efficient to use so that once the user has learned the system, a high level of productivity is possible [22].

Added value: The added value is usually in the form of creative use of the possibilities that the computer offers, for example, voice, image, and video files: the learners can choose a media that best fits their preferences [21].

Effectiveness: The capability of the software product to enable users achieves specified tasks with accuracy and completeness [25]. The degree to which specified users can achieve specified goals with accuracy and completeness in a specified context of use [25].

Satisfaction: The system should be pleasant to use so that users are subjectively satisfied when using it, they like it [22].

Learnability: The system should be easy to learn so that the user can rapidly start getting some work done with the system [22].

Interactivity: Interactivity is supported through the easy and user-friendly accessibility of the subject information and task-based activities [26].

Feedback: The system should continuously inform the user about what it is doing and how it is interpreting the user's input [22].

Consistency: Consistency is one of the most basic usability principles. If users know that the same command or the same action will always have the same effect, they will feel more confident in using the system, and they will be encouraged to try out exploratory learning strategies because they will already have part of the knowledge needed to operate new parts of the system [22].

Learner-control: Describes the student's ability to control the order in which they would like to perform activities [21].

User profile: is a visual display of personal data associated with a specific user, or a customized desktop environment. A profile refers therefore to the explicit digital representation of a person's identity. A user profile

can also be considered as the computer representation of a user model. A profile can be used to store the description of the characteristics of person. This information can be exploited by systems taking into account the persons' characteristics and preferences [27].

Age: the length of time that a person has lived or a thing has existed, a distinct period of history [28].

Gender: is the state of being male or female in relation to the social and cultural roles that are considered appropriate for men and women [29].

Level of experience: Requires a basic knowledge and some experience in the system. The focus should be on "How does it work?" and "Benefits of using it" and should include detailed examples. Some evaluation of alternative methods would be appropriate at this level. Key words in the learning objectives could include: execute, perform, apply, and accomplish [29].

4. EXPERIMENTATION

The main purpose of the experiments is to measure the attributes of the model. The Experiment consists of five major tasks. Each task has a different set of activities to be performed by users. Each action covers a different range of fields that cover the main features of WERMSs. Table 1 below shows the tasks selected for the experiments.

Table. 1 Tasks and task specifications for experimentation

Task1: Registration in the System: - Click on the Login icon in the main menu at the top of the page. - Click on the link is not registered below the Login button. - Fill in the boxes with the required information. - Click Insert to finish the Registration process.
Task2: Access to the System and use it: Before you can use the system and login you must have an account. - Click on the Login icon in the main menu at the top of the page. - In the login box type your user name and password. - Click Login. - Selecting the educational resource. - Click downloads this file to save it in your computer
Task3: Send Messages to Administration of the System - Click on the icon contact services in the main menu at the top of the page. - In the login box type your user name and password. - Click the Login button. - Fill in the boxes with the required information. - Click Send to send the message to the administrator.
Task4: Download Lecture from the System - Select the image file is located in front of the name of the book or in a table of educational resources on the home page. - Click on the link of your choice. - Click to download this file to save it in your computer.
Task5: Search on the System - Click on the Icon what do you want in the main menu at the top of the page. - In the login box type your user name and password. - Click Login. - In the search box, type the name of the resource that you are looking for. - Click Search. - Click the source for downloading.

Measurement of variables: The following are the variables used to measure the attributes of the model

- Number of steps
- Time spend on a task
- Number of errors
- Number of helps.
- Number of unfinished tasks

Sampling and Users Profiles: A total of 20 students were selected who were at different levels. Table 2 and Figure 2 show the distribution of the respondents by age who participated in the experiments.

Table. 2 Distribution of respondents by age

Age	Frequency	Percent
from 20 to 25	17	68.0
from 25 to 30	5	20.0
from 30 to 35	3	12.0
Total	25	100.0

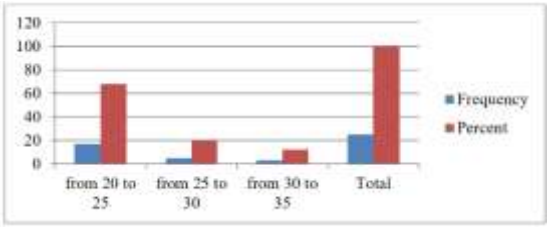

Figure. 2 Distribution of respondents by age

Table 3 and Figure 3 presents the number of additional steps and average time on all tasks.

Table. 3 The number of additional steps and average time on tasks

Tasks	Number of additional steps	Average of Time
Task 1	1	1.95
Task 2	1	1.75
Task 3	1	1.85
Task 4	1 – 2	1.5
Task 5	0	1.85
Total	5	8.9

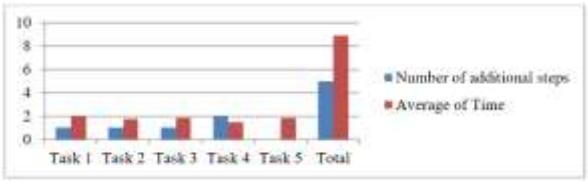

Figure. 3 The number of additional steps and average time on tasks

Table 4 and Figure 4 reflect the total number of errors, total number of helps and the total tasks not completed.

Table. 4 Total errors, helps and tasks not completed

Tasks	Total Number of errors	Total Number of helps	Total of Task not complete
Task 1	12	15	0
Task 2	1	7	1
Task 3	0	7	0
Task 4	2	4	1
Task 5	4	7	0
Total	19	40	2

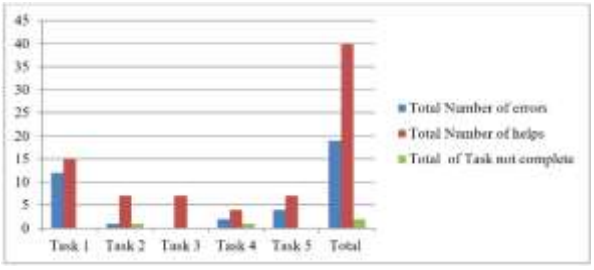

Figure. 4 Total errors, helps and tasks not completed

The results in Table 5 and Figure 5 illustrate:
- The total number of steps to accomplish tasks
- Total time to complete tasks

Table. 5 Total steps and time of all tasks

Tasks	Total number of steps	Total Time
Task 1	88	39
Task 2	101	35
Task 3	108	37
Task 4	67	30
Task 5	120	37

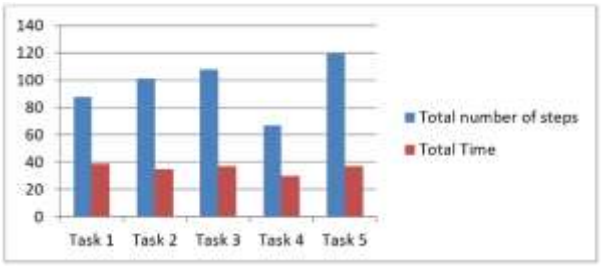

Figure. 5 Total steps and time of all tasks

The results in Table 6 and Figure 6 illustrate:
- The average number of steps to accomplish tasks
- Average time to complete tasks

Table. 6 Average number of steps and time on tasks

Tasks	Average number of steps	Average Time
Task 1	4.4	1.95
Task 2	5.05	1.75
Task 3	5.4	1.85
Task 4	3.35	1.5
Task 5	6	1.85

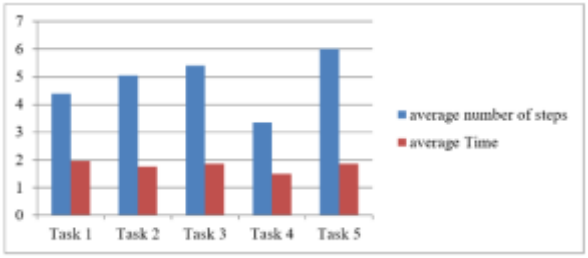

Figure. 6 Average number of steps and time on tasks

The results in Table 7 and Figure 7 illustrate that:
- The average number of errors to accomplish tasks
- The average number of help to accomplish the tasks
- The average number of unfinished tasks

Table. 7 Average of errors, helps and task not complete

Tasks	Average number of errors	Average number of help	Average Task not complete
Task 1	0.6	0.75	0
Task 2	0.05	0.35	0.05
Task 3	0	0.35	0
Task 4	0.1	0.2	0.05
Task 5	0.2	0.35	0

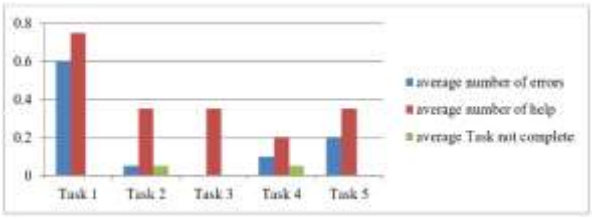

Figure. 7 Average of errors, helps and task not complete

5. RESULT DISCUSSION AND ANALYSIS

Testing the Hypotheses was performed on the basis of the level of significance. If the level of significance is greater than 5% (0.05), this means that the value of calculated Chi-Square is less than the value of tabular Chi-Square and therefore there is a statistical significance. In this case, the null hypothesis will be rejected the alternative hypothesis (the research hypothesis) will be accepted.

a) The relation between Learnability and usability

To test whether there is a relation between Learnability and usability the test was performed. The results reported in Table 8 below shows that there was a significant difference between Learnability and usability.

Table. 8 Chi-Square test between learnability and usability

Hypotheses	Chi-Square	Sig. (P.value)	df
Learnability affects usability of WERMSs	8.376	0.215	4

b) The relation between Inactivity and usability

To test whether there is a relation between Inactivity and usability test was performed. The results reported in Table 9 below shows that there was a significant difference between Inactivity and usability.

Table. 9 Chi-Square test between inactivity and usability

Hypotheses	Chi-Square	Sig. (P.value)	df
Interactivity affects usability of WERMSs	8.441	0.350	6

c) The relation between Consistency and usability

To test whether there is a relation between Consistency and usability test was performed. The results reported in Table 10 below shows that there was a significant difference between Consistency and usability.

Table. 10 Chi-Square test between consistency and usability

Hypotheses	Chi-Square	Sig. (P.value)	df
Consistency affects Usability of WERMSs	7.909	0.369	6

d) The relation between Learner's control and usability

To test whether there is a relation between the Learner's control and usability test was performed. The results reported in Table 11 below shows that there was a significant difference between Learner's control and usability

Table. 11 Chi-Square test between learner's control and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Learner's control affects the Usability of WERMSs	10.863	0.220	7

e) The relation between Effectiveness and usability

To test whether there is a relation between Effectiveness and usability test was performed. The results reported in Table 12 below shows that there was a significant difference between Effectiveness and usability.

Table. 12 Chi-Square test between effectiveness and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Effectiveness affects Usability of WERMSs	9.6	0.292	7

f) The relation between Efficiency and usability

To test whether there is a relation between Efficiency and usability test was performed. The results reported in Table 13 below shows that there was a significant difference between Efficiency and usability.

Table. 13 Chi-Square test between efficiency and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Efficiency affects Usability of WERMSs	6.869	0.401	6

g) The relation between Satisfaction and usability

To test whether there is a relation between Satisfaction and usability test was performed. The results reported in Table 14 below shows that there was a significant difference between Satisfaction and usability.

Table. 14 Chi-Square test between satisfaction and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Satisfaction affects Usability of WERMSs	12.794	0.171	7

h) The relation between Age and usability

To test whether there is a relation between age and usability test was performed. The results reported in Table 15 below shows that there was a significant difference between age and usability.

Table. 15 Chi-Square test between age and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Age affects the Usability of WERMSs	5.382	0.366	5

i) The relation between Gender and usability

To test whether there is a relationship between gender and usability test was performed. The results reported in Table 16 below shows that there was a significant difference between gender and usability.

Table. 16 Chi-Square test between gender and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Gender affects the Usability of WERMSs	2.653429	0.477	2

j) The relation between Level of experience and usability

To test whether there is a relation between Level of experience and usability test was performed. The results reported in Table 17 below shows that there was a significant difference between Level of experience and usability.

Table. 17 Chi-Square test between level of experience and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Level of experience affects the Usability of WERMSs	3.672	0.291	2

6. CONCLUSION

The main objective of this study was to propose a model for evaluating the usability of WERMSs. Usability evaluation was done empirically and has been adopted by involving users who have regular interaction with the system. The model consisted of effectiveness, efficiency, satisfaction, learnability, consistency, motivation,

interactivity, learner's control, age, gender and Level of experience as the factors that affect the usability. The model was tested and verified using questionnaires and experiments. The results showed that the Effectiveness, Efficiency, and satisfaction affect the usability of WERMSs. The results also showed that the Learnability, Motivation, Interactivity, Consistency and Learner's control affect the usability of WERMSs. The results also showed that the Age, Gender, Level of experience affects the usability of WERMSs. The results of the experiment showed that the system was efficient, effective and easy to use.

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