

# A proposed model for the usability of web based educational resources management systems

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## ABSTRACT

The main purpose of web based Educational Resources Management System (ERMS) is to deliver knowledge, share information and help learners in their learning activities in 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 of the challenges that face the design of these systems. This study proposes a model for evaluating the usability of ERMS. The model introduced effectiveness, efficiency, satisfaction, learnability, interactivity, consistency, motivation and learner's control as the attributes that determine the usability of such systems. The model was tested and verified using questionnaires and experiments. The results showed that the effectiveness, efficiency, satisfaction, learnability, motivation, interactivity, consistency and learner's control affects the usability of ERMS.

**Keyword:** web based applications; educational resources management; usability; usability evaluation; e-learning;

## 1. INTRODUCTION

Usability of ERMSs is a great significance because their success depends upon basic usability principles. This paper is an attempt to propose 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 model for usability of ERMS 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 provide model for usability and defining practical, fast and low-cost tools in order to analyze the usability of Educational resources management system (ERMSs) according to this model. Kashif [8] pointed out that 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. Usability of e-learning applications is of great significance because their success depends upon basic usability principles. The criteria for judging the success can be defined by user satisfaction level after the user's interaction with interface of e-learning system [8]. Appropriate use of usability evaluation methods according to given scenarios is an important aspect [8]. 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 [8].

## 2. RELATED WORK

**Educational resources management systems:** is a modern and powerful Management Information System, designed specifically to meet the challenges of the Education sector. It is the Management Information System (MIS) your institution needs, to support the dynamic environment you work in and add value to your business.

**Educational resources management:** is a modern and powerful Management Information System, designed specifically to meet the challenges of the post Education sector. It manages the complete Learner life-cycle, from initial enquiry through to completion [47]. Educational Resources management should be flexible and scalable in order to support any learning and be adaptable to changes. Efficient and effective deployment of resources requires that educational resources management concepts and principles be used in all phases of resources management and learning response [47]. A Web-based application refers to any program that is accessed over a network connection using HTTP, rather than existing within a device's memory. A web application is an application utilizing web and web browser technologies to accomplish one or more tasks over a network, typically through a web browser [46].

**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 [36]. E-learning can also be defined broadly as any use of Web and Internet technologies to create learning experiences [31]. 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

[31].” 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 [8]. The objectives of e-learning are to facilitate and assist people by delivering appropriate contents and services to fulfill user needs [8].

**E-learning system:** 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 [35]. 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 [35].

**Web based educational systems (WBESs):** WBESs offer interesting delivery mechanisms to teachers and learners [10]. Governance and accountability are key criteria to consider during the deployment of these WBESs [10]. Assessment of WBESs also needs to be done to determine its effectiveness [10].

**E-Learning management electronic system (EMES):** An integrated computer system that manages the educational process after the system aims to facilitate the process of interaction between the student and faculty member [35]. An E-learning management system is an integrated computer system to serve the educational process, where the system aims to facilitate the process of interaction between students and faculty, and its features are [35]:

- Course development
- Ease of use.
- Arabic and any Languages Support.
- Able to assess students
- Communication between student and faculty.
- Quality of scientific content design and using of the latest technology for educational means.
- Develop self-learning among students.
- Ease in management and support of the educational process

**Usability:** Usability is a term which refers to the interaction of users with any software systems [15]. ISO 9241-11 [40] defined it 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”. The definition of usability from ISO/IEC 9126 [42]: "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". Another definition of the usability from ISO/IEC 9126-1 [41]: "The capability of the software product to be understood learned, used and attractive to the user, when used under specified conditions". Nielsen [15] introduced Learnability, Efficiency, Memorability, Errors and Satisfaction as attributes that determines the Usability. According to Gilbert Cockton [37] Usability Evaluation assesses the extent to which an interactive system is easy and pleasant to use.

**Usability evaluation:** 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 [21]. 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 [21]. Dix et al [3] 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.

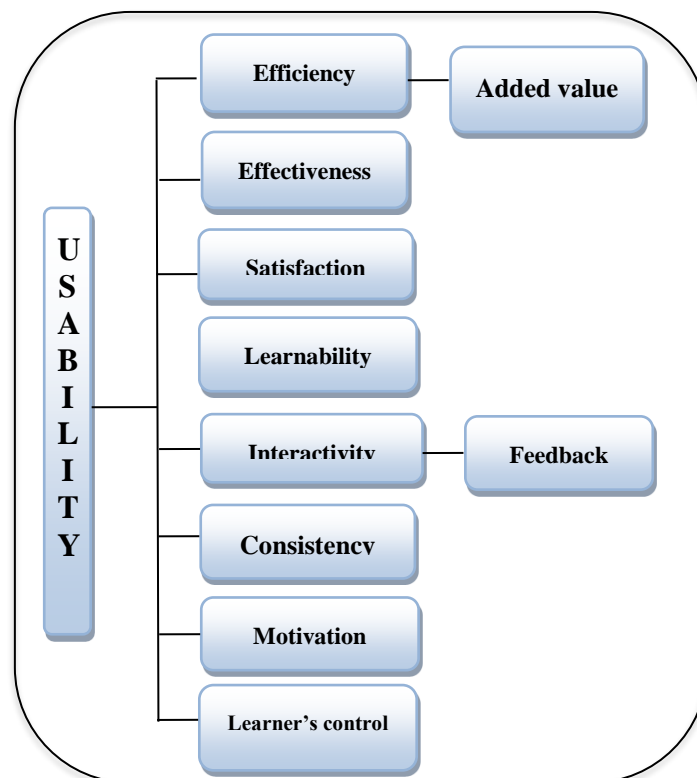
**Usability of educational resources management systems:** Usability plays an imperative role for the success of e-learning applications. If an e-learning system is not usable, the learner is forced to spend much more time trying to understand software functionality, rather than understanding the learning content [30]. Moreover, if the system interface is rigid, slow and unpleasant, people feel frustrated are likely to walk away and forget about using it [30]. Andrina et al., [1] pointed out that Usability of pedagogical systems is 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 [1]. Fitzpatrick & Ssemugabi [20] [25] pointed out that in order to evaluate the usability of system and to determine usability problems, it is important to

select appropriate usability evaluation /methods. Gray et al., [6] considering efficiency, time, cost-effectiveness, ease of application, and expertise of evaluators. According to Melis et al.,[13] to designing 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 [13].
- Pedagogical usability, which aims at supporting the learning process. Both aspects of usability are intertwined and tap the user’s cognitive resources [13].

### 3. METHODOLOGY

**The proposed Model:** In order to assess the usability educational resources management system, the study proposes a model based on ISO 41-11 [40] and others usability models such as effectiveness, efficiency satisfaction, learnability, interactivity, consistency, motivation and learner’s control. As shown in figure (1) the attributes of the model are:



**Figure (1) Proposed Model for the Usability of WEMRs**

**Efficiency:** The system should be efficient to use, so that once the user has learned the system, a high level of productivity is possible. [13].

**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 [19].

**Effectiveness:** The capability of the software product to enable users achieves specified tasks with accuracy and completeness [43]. The degree to which specified users can achieve specified goals with accuracy and completeness in a specified context of use [43].

**Satisfaction:** The system should be pleasant to use, so that users are subjectively satisfied when using it; they like it [13].

**Learnability:** The system should be easy to learn so that the user can rapidly start getting some work done with the system. [13].

**Interactivity:** Interactivity is supported through easy and user-friendly accessibility of the subject information and task-based activities. [27].

**Feedback:** The system should continuously inform the user about what it is doing and how it is interpreting the user's input [13].

**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 [13].

**Motivation:** The material provided by web based application should contain intrinsically motivating tasks and examples [19].

**Learner-control:** Describes the student's ability to control the order in which they would like to perform activities [19].

#### 4. MODEL VALIDATION

##### 4.1 Design of experiments

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

**Table. 1** Shows tasks of the experiments

Tasks
Task 1: Registration in the system
Task 2: Access to the system to see existing resources
Task 3: contact Services with students
Task 4: download Lecture from the System
Task 5: Search on the System

##### 4.2 Measurement of variables

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

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

##### 4.3 Sampling and users profiles

A total of 20 students were selected who were at different levels. Tables below shows the distribution of the users 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

**Table. 3** The number of additional steps & 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
<b>Total</b>	<b>5</b>	<b>8.9</b>

**Table. 4** The Total errors & helps & task not complete on tasks

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
<b>Total</b>	<b>19</b>	<b>40</b>	<b>2</b>

The results below illustrate:

- The total number of steps to accomplish tasks
- Total time to completion tasks

**Table. 5** Total steps & time on 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

The results below illustrate:

- The average number of steps to accomplish tasks
- Average time to completion tasks

**Table. 6** Average of steps & 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

The results below illustrate:

- The average number of errors to accomplish tasks
- The average number of helps to accomplish the tasks
- The average number of unfinished tasks

**Table. 7** Average of errors & helps & task not complete on tasks

Tasks	average number of errors	average number of helps	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

## 5. DATA ANALYSIS AND RESULTS

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.

### 5.1 The relation between learnability and usability

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

**Table. 8** Chi-Square test of the relation between Learnability and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Learnability affects Usability of WBERs.	8.376	0.215	4

### 5.2 The relation between motivation and usability

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

**Table. 9** Chi-Square test of the relation between motivation and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Motivation affects Usability of WBERs.	9.088	0.236	6

### 5.3 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 (10) below shows that there was significant difference between Inactivity and usability.

**Table. 10** Chi-Square test of the relation between inactivity and usability

Hypotheses	Chi-Square	Sig. (P.value)	Df
Interactivity affects Usability of WBERs	8.441	0.350	6

#### 5.4 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 (11) below shows that there was significant difference between Consistency and usability

**Table. 11** Chi-Square test of the relation between consistency and usability

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

#### 5.5 The relation between learner's control and usability

To test whether there is a relation between Learner's control and usability test was performed. The results reported in Table (12) below shows that there was significant difference between Learner's control and usability

**Table. 12** Chi-Square test of the relation between learner's control and usability

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

#### 5.6 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 (13) below shows that there was significant difference between Effectiveness and usability

**Table. 13** Chi-Square test of the relation between effectiveness and usability

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

#### 5.7 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 (14) below shows that there was significant difference between Efficiency and usability

**Table. 14** Chi-Square test of the relation between efficiency and usability

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

#### 5.8 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 (15) below shows that there was significant difference between Satisfaction and usability

**Table. 15** Chi-Square test of the relation between satisfaction and usability

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

## 6. CONCLUSION

The main objective of this study was to propose a model for evaluating the usability of ERMS. 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 and learner's control 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 affects the usability of ERMS. The results also showed that the Learnability, Motivation, Interactivity, Consistency and Learner's control affects the usability of ERMS. The results also showed that the Age, Gender, Level of experience affects the usability of ERMS. The results of experiment showed that the system was efficient, effective and easy to use.

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