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### **USABILITY EVALUATION METHODS: A POINT OF CHARACTERISTICS AND CRITERIA**

*In the last years e-learning becomes a powerful tool to support modern education. Education should be of high quality and its can be achieved by using effective and efficient e-learning applications. In e-learning systems the usability and evaluation of it is of a major concern. It is important to choose the correct method of evaluation. But despite recent advances of electronic technologies in e-learning and the large number of existing evaluation methods a consolidated evaluation methodology for e-learning applications is not available yet. The purpose of this article is to review the evaluation methods of usability and present the results of research by the author in the field of usability evaluation.*

In the field of software design and engineering, usability in its primary sense, intends to define rules to design applications to meet users' needs. E-learning systems follow the same rule with the exception that due to their complex nature, their usability evaluation is more complicated and challenging. Usability in online educational systems involves technical usability and pedagogical usability. Similar to other interactive systems, usability is related to easiness of the system usage. The pedagogic usability of an e-learning system also refers to how easy and effective it is for a learner to interact with the system. In addition, human factors such as user's physical, cultural, and social environment needs to be taken into account.

A review of the literature shows a variety of usability evaluation methods. But a consolidated evaluation methodology for e-learning applications is not available yet.

Therefore, the actual problem is to develop a universal methodology for usability evaluation of e-learning applications which would include the necessary criteria and meets specified requirements.

Considering the above, a new a new approach to assess usability of e-learning applications will be offered by the authors.

Usability as a technique to measure the quality of computer systems has been discussed for several decades. Generally, usability has been defined as the extent to which an application is learnable and allows users to accomplish specified goals efficiently, effectively, and with a high degree of satisfaction [1].

The concept of usability evaluation reaches back to more than a decade. Hartson et al. [2] defines the term usability evaluation methods as any methods or techniques used to perform usability evaluation with emphasis of formative usability evaluation of iteration design at any stage of its development. Fitzpatrick [3] argues that usability evaluation method is a systematic procedure for recording data related to end-user interaction with a software product or system. Usability evaluation measures the effectiveness, efficiency and satisfaction of system's usability is critical to discover essential issues with the system during the different stages of system

development life cycle. Since there are several different approaches to evaluate usability of interactive systems (e.g. e-learning systems).

Experimental or empirical evaluation is based on the use of scientific experimental methods to test hypotheses about the usability of an interactive system [4]. Though Experimental evaluations are reliable, using this approach as a method of usability evaluation in E-learning systems is unsuitable since experimental evaluations are usually very expensive and may require sophisticated equipment [7].

Model-based evaluations like empirical evaluations are appropriate for identifying usability problems in quantitative approach. It uses cognitive and design models to evaluate interfaces [5]. In fact it refers to the process of using a model of how the users would use a proposed system to obtain predicted usability measures by calculation or simulation. Model-based evaluations are rarely used in evaluation of e-learning systems usability, since they are still limited and immature, expensive to apply and also there is limited guidance on how to apply them.

Query techniques are based on the philosophy that the best way to identify usability problems of a system is to ask the user directly. These methods have the advantage of being relatively simple and inexpensive to administer [5]. These characteristics are attractive for evaluation of E-learning systems because educators and course designers need efficient and cost-effective methods to evaluate these applications. But it has some disadvantages. These quantitative approaches are mono semantic that must be supplemented by qualitative ones, which focus on how and what the learner learns. This method was cited by other researchers [4] as Survey evaluation. Survey evaluation elicit users' subjective opinions about the usability of the system [4] and it may consist of techniques such as Paper Surveys with questionnaires, Online surveys with questionnaires, and Questionnaires for user interaction satisfaction.

Observational evaluation refers to observing or monitoring users' behavior as they use the system [4, 5]. The advantage of this method is in detecting the usability problems of learners simultaneously with evaluation process. However, this method has some disadvantages such as dependency to expensive equipment (like video and audio recorder), and changes in users' behavior as they are aware that they are being observed.

Review-based evaluation uses results from previous studies in evaluation as evidence to support or refute aspects of a user interface [5]. In this method, principles from experimental psychology and HCI literature are applied to provide evaluation criteria. The major concerns are to ensure that results are transferable to the system and context of the study has to be taken into account in the evaluation process.

Before discussing the expert-based usability evaluation, it is necessary to clarify some points. In this paper we evaluate UEMs that can be used in e-learning system based on two factors, 1) the stage of the system development process and 2) who will be involved in evaluation. According to the first factor, we categorize two major evaluations into formative and summative evaluation. Formative evaluation is conducted during the design and construction phases. It focuses on usability problems that need to be solved and fixing bugs throughout these phases before the product is released. Therefore, the design will be improved. Summative evaluation is

conducted after the release of the product. It compares the level of usability achieved in interaction of with the system and the result of that will be used to improve the interface as a whole and satisfy more user needs. In summary, formative evaluation is performed during the development to improve design and summative evaluation is done after development to assess a design [6].

Therefore, general classification of UEM's is given at the figure 1.

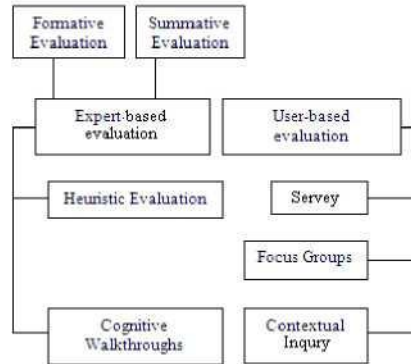


Figure 1. General classification of UEM's.

Also, it's can be possible to give one more classification to UEMs considering two categories: analytical and empirical.

Usability evaluation methods can be categorised into two categories, “analytical” and “empirical” methods. The difference is in which way the methods work. Analytical methods are done by usability experts, who put themselves in the intended end-users position. Based on the experts expertise and usability heuristics the expert validates the software [7], and as no user needs to be involved, these evaluation methods fits best early in the development process. Examples of analytical methods are “Guidelines”, “GOMS” or “Heuristic Evaluation”. The second category, empirical evaluation methods, requires a user to test the software and it mainly consists of usability tests and questionnaires. Theseempirical evaluation methods are better suited later on in a development process or when the system is already in use and its goal is to determine the overall usability of the system. It is important to note, however, that these categories should not replace each other, rather complement each other.

In view of this can be identified next criteria for choosing usability evaluating methods:

1. Stage of development life cycle
2. Budget constraint
3. Time limitations
4. Accuracy of result
5. Qualitative or quantitative measurements
6. UEMs advantages or disadvantages

These factors should be considered in selecting the UEM. In general, evaluation done in early phases of system development life cycle and before implementation phase tend to involve experts instead of users, while those done after implementation phase usually involve users. In some cases it may need to use two evaluation methods.

### Conclusions

All objectives have been achieved in this study. the broad classification of usability evaluation methods is given. The main criteria for the selection of the usability evaluation methods are considered.

For further experiment, the authors propose to select the survey or questionnaire technique, but as evaluators there should be students, professors and experts of this field. So, that way will be considered both didactic and technical components of usability [8].

Also specifically for this experiment will be done a questionnaire and compile a list of the main criteria for this study.

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