# Usability Evaluation of E-Learning Systems

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## INTRODUCTION

The traditional approach for designing user interface for information systems[1] has focused on the capabilities of the technology. This "technology-centered approach" has frequently neglected the actual user requirements. The focus of such a design philosophy is to create interface systems that are based on opportunities presented by the capabilities of technology. In contrast, the user-centered design starts with the requirements of the end users and exploits the capabilities of technology to address users' needs, preferences and abilities. There is no doubt about the fact that such a shift from "technology-centered approach" to "user-centered approach" has increased the *usability* of the designed systems. However, in the context of e-learning systems, user-centered design is, in itself, not adequate to meet all the learner's needs. In addition to being user-centric, in terms of convenience, e-learning systems must also achieve the desired "learning outcomes". Thus, usability of e-learning systems has wider connotations compared to other information systems. The design for such systems, which aims at satisfying the learning needs more closely, is often referred to as learner-centered design (LCD) and goes beyond the usual user-centered design.

Usability evaluation which refers to a series of activities that are designed to measure the effectiveness of a system as a whole, is an important step for determining the acceptance of system by the users. Usability evaluation is becoming important since both user groups, as well as tasks, are increasing in size and diversity. Users are increasingly becoming more informed and, consequently, have higher expectations from the systems. Moreover "system interface" has become a commodity and, hence, user acceptance plays a major role in the success of the system. Currently, there are various usability evaluation methods in vogue, like cognitive walkthrough, think aloud, claims analysis, heuristic evaluation, and so forth. However, for this study we have chosen *heuristic evaluation* because it is relatively inexpensive, logistically uncomplicated, and is often used as a discount usability-engineering tool (Nielsen, 1994). Heuristic evaluation is a method for finding usability problems in a user interface design by having a small set of evaluators examine an interface and judge its compliance with recognized usability principles.

The rest of the chapter is organized as follows: we first look at the definition of e-learning, followed by concepts of usability, LCD, and heuristics. Subsequently, we introduce a methodology for heuristic usability evaluation (Reeves, Benson, Elliot, Grant, Holschuh, Kim, Kim, Lauber, & Loh, 2002), and then use these heuristics for evaluating an existing e-learning system, GETn[2]. We offer our recommendations for the system and end with a discussion on the contributions of our chapter.

## BACKGROUND

### E-Learning

According to MSN Encarta, electronic learning (e-learning) is "the acquisition of knowledge and skills using electronic technologies such as computer and Internet-based courseware and local and wide area networks". E-learning applications can be broadly classified into two categories: *offline learning,* where learning is imparted through the use of digital media devices like CD-ROMs, DVDs, and so forth, and *online learning,* where learning is imparted through computer networks using Web-based tools like, virtual classrooms, digital collaboration (discussion forum, chat, electronic bulletin boards, listserv, etc.). Web-based learning operates in a computer-networked environment and many of these systems make use of the Internet. In this chapter, we restrict our discussion to the usability of Web-based learning management systems (LMS). Such LMS not only offer online courseware, but also track participants' progress in learning.

### Usability of E-Learning Systems

The ISO 9241 (1998) defines usability 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." Usability is the quality attribute that assesses the *ease of using* the application by users to accomplish their specified goals effectively, efficiently, and with a high level of satisfaction. In addition to ease of use, a usable e-learning system should be *useful* for the learners in accomplishing their learning task (Venkatesh, Morris, Davis, & Davis, 2003). Usability analysis helps increase the likelihood of a system being classified as not only easy to use but also useful from the learners' perspective.

Apart from the two basic objectives highlighted above, researchers have suggested several additions to the usability model. Constantine & Lockwood (1999) highlighted that a usable e-learning system must achieve: learnability, rememberability, efficiency in use, reliability in use, and user satisfaction. An effective e-learning system should be interactive and provide feedback, have specific goals, motivate users, communicate a continuous sensation of challenge, provide suitable tools, and help avoid distractions interrupting the learning stream (Costabile, De Marsico, Lanzilotti, Plantamura, & Roselli, 2005). Incorporating feedback, curiosity, comprehensiveness, and challenges in the e-learning system can help achieve the motivational aspect of usability (Shilwant & Haggarty, 2005). The *usability* definition for e-learning is incomplete without incorporating *learnability* aspect into the systems. Hence, in addition to being user-centric, e-learning systems should be designed with a learner-centric approach.

## Learner-Centered Design

Learnability is defined as the ease and speed with which users can figure out the way to use a product (Soloway, Guzdial, & Hay, 1994). To incorporate learnability into the usability framework, learner-centered design (LCD) was proposed by Soloway and Pryor (1996). The key to developing effective e-learning systems is to adopt the LCD methodology, which targets to help learners acquire knowledge efficiently and effectively even through an e-learning tool, which is new for them. Since learners do not undergo extensive training before using the e-learning system, system design should be such that the learners can focus on the "actual learning" and not on "learning to use the e-learning system".

In LCD, the design process considers a variety of learner categories due to differences in personal learning strategies, experiences in the learning domain, and motivations in affording the learning task (Ardito, De Marsico, Lanzilotti, Levialdi, Roselli, Rossano, & Tersigni et al., 2004). The designer must also consider prior knowledge and self efficacy (computer skills) of the learner and focus on learners' needs and goals in a simple way. For example, the use of multimedia files as instructional mode should not overwhelm the users and disrupt their learning process. The e-learning interface design should also integrate various pedagogical methodologies and traditional teaching strategies. The aim should be to help learners achieve their learning objectives in a more productive, efficient and effective way.

# USABILITY EVALUATION IN E-LEARNING

Usability evaluations in the case of e-learning systems are difficult to employ due to the time, budget, and knowledge constraints. Consequently, there is a lack of e-learning usability studies, which has adversely influenced e-learning design and development in practice.

Feldstein (2002) pointed out that producers and consumers of e-learning applications have no standardized means to evaluate the extent to which any e-learning application is usable. The norm generally followed for assessing usability is the *satisfaction level* of the user. This may not be a fair indicator of the actual usability because it does not take into account the *learning objectives*. A user may be satisfied with attributes of the system, other than those achieving learning outcomes. Hence there is a need for understanding e-learning usability in greater detail.

## Heuristic Usability Testing

Feldstein (2002) suggested the use of "heuristics" for testing the usability of e-learning systems. Heuristic usability testing techniques offer simple and cheap means for assessing e-learning systems. Nielsen (2000, 1994) offered a set of simple usability heuristics, which focus on giving timely and useful feedback. Notess (2001) pointed out that heuristic evaluations hold promise for online learning but the challenge for most types of online learning is that established sets of heuristics do not exist. Many researchers are of the view that Web design heuristics that have developed around e-commerce can be suitably modified and used for the evaluation of e-learning systems. Squires & Preece (1996) established the ineffectiveness of simple heuristic usability testing and highlighted that Web design heuristics have to incorporate various learning theories and pedagogical guidelines to be effective for e-learning. They added socio-constructivist tenets to Nielsen's (1994) heuristics and proposed a set of heuristics for "learning with software" (Squires & Preece, 1996). In due course, taking into account usability as well instructional design features, Reeves, et al. (2002) expanded and customized Nielsen's (1994) ten heuristics developed for software in general, to enunciate fifteen heuristics for evaluating e-learning systems (Table 1), which we use in our current study.