Evaluating Usability to Improve Efficiency in E-Learning Programs

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INTRODUCTION

The history of usability began almost 20 years ago when computers were about to be used outside the designer and programmer environment. Until the 1980s software was mostly produced and used by designers so usability was taken for granted.

In 1983, the first computers providing a graphic interface and a mouse were produced by Apple for distribution on a large scale. The gradual introduction of computers to offices and houses began creating usability problems. The development of computers was guided mainly by the technology available at that time. Gradually, the impact of training costs, errors in the interaction between user and computer, and the evolution of studies regarding the "human factor", carried out by psychologists and ergonomics experts, led to a reflection on the importance of the target users.

In order to facilitate usability, the first guidelines regarding the human factor were introduced (the first guidelines regarding the graphic interfaces were written by Apple in 1978). The first user models were developed on the basis of research in the field of cognitive psychology which emphasized the human limits in elaborating detailed information and establishing the minimum requirements that a software needs to possess. In the first usability laboratories, usability, and ergonomics experts worked to develop guidelines and user models as well as to evaluate product usability. In that period cognitive ergonomics developed as a result of the application of cognitive psychology theory to both interface planning and the dialogue between user and computer. However, these developments were not enough to establish usability. In addition, likely usability defects detected during the final phase of evaluation could be rarely corrected because of cost and time problems. The first attempts to change this situation were done thanks to the integration of the *waterfall model* to the traditional usability activities. The analysis of requirements phase was intermingled with new methods aimed at improving the identification of the user's needs in terms of functionality and usability. Rapid-prototyping was introduced in the project phase and usability tests were often administered.

In the second half of the 1980s, in Scandinavia, the so-called *participatory design* encouraged the user's participation in the design process, not simply as an individual but also as a member of a certain culture and organization. On the other hand, the *user-centered model* or *human-centered design* that began to be adopted at the end of the 1980's, was characterized by three aspects (Norman & Draper, 1986):

- **Direct involvement of the target user:** In all the development phases from the analysis of the requirements to the final evaluation, the target user is as responsible for the product as the designer is
- **Interactivity of the process:** This process is articulated in cycles characterized by prototyping, evaluation and prototype changes, and achievement of the final product
- **Multidisciplinary team that designs a product:** Different people (designers, usability experts, software developers, graphic designers, technical writers, etc.) are all concerned with the outcome of a product

SOME DEFINITIONS OF USABILITY

ISO/IEC 9126 standard (*Information technology—Software product evaluation—Quality characteristics and guidelines for their use*) defines usability as "the capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions". On the other hand, ISO 9241-11 standard (*Ergonomic requirements for office work with visual display terminals—Guidance on usability*) defines 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."

Researchers have struggled to clarify the concept of usability. According to Shneiderman (1992), usability includes factors such as *efficiency of use, learnability, memorability and satisfaction.* Moreover, Nielsen (1993), one of the leading experts in this field, defines usability as a measure of the quality of a person's experience in interacting with a product or a system. As a consequence in his opinion, a product is usable when it can be learned quickly and effectively, and enables a user to accurately complete a task, is memorable, allows only few and noncatastrophic errors and is satisfying to use.

In short, a product is usable when:

- It fits the user's needs and expectations
- It is easy to understand, learn, use and is attractive
- It allows the user to work correctly, quickly and with satisfaction

Besides synthesizing various definitions of usability, these elements highlight the steps to follow during the product development cycle in order to ensure the usability of a product. In order to achieve this goal, it is necessary to know the users' characteristics, the activities that they perform and their environment. As for the ease with which users can understand and employ the product, today several usability principles and guidelines are available. They are mainly based on the cognitive and behavioural aspects of human-computer interactions. However, these aspects are not sufficient. To ensure usability, it is fundamental to interact regularly with future users. In this way it is possible to verify, evaluate and, if necessary, measure the project choices in terms of user satisfaction.

EVALUATING USABILITY

There are several methods to evaluate the usability of software and each one has specific characteristics that make it suitable to particular products during the initial, *in itinere* and final phases depending on the specific goals of the evaluation.

Usability tests need to be administered when the interface is in the planning stage. Evaluating once is not enough, however. Thus, it is advisable to repeat and integrate tests during all the process. Nielsen (1993) says that it is better to deliver a usability test with five people from time to time rather than only once with 20 users.

As stated before, usability is meaningful only when there is interaction with a user. Thus, in order to evaluate usability it is necessary to involve a user who is interested in interaction. As a consequence, to improve interactivity, studies of usability involve two major categories of analysis. The first is speculative and more economical: various experts analyze the software or an interface prototype on the basis of certain propositions in order to identify problems, ultimately providing a series of observations and suggestions for improvement. The second is more expensive but more precise: it is based on the direct observation of a typical user who tries to use the software during development. On the basis of the different tasks performed by the user and of the difficulties he/she meets, some suggestions may be made in order to facilitate planning.

The first category utilizes the following analytic methods for evaluating usability:

- Task analysis
- Cognitive walkthrough
- Heuristic evaluation

While these methods are all different, each of them utilizes expert evaluation. It is important to emphasize that this analysis is carried out on a subjective basis according to the analyst's preference or to general experience. Analysis is then carried out according to certain principles that are set on an empirical basis.

Task analysis concerns the examination of task components, estimating the steps necessary to develop a specific procedure. In the case of *cognitive walkthrough,* the cognitive features of users should be taken into account, checking the existence of any problems on the interface/prototype. *Heuristic evaluation* evaluates the