Usability and Learnability Evaluation of Web-Based ODL Programs

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INTRODUCTION

The rapid establishment of third generation distance learning environments, the so-called Web-based or teleteaching environments, brought some problems with it. The main means for the delivery of the new educational approach is the World Wide Web, and there are some good reasons for it: It is easily accessible by many groups of learners. It supports multiple representations of educational material and various ways of storing and structuring this information. It is powerful and easy to use as a publishing medium. Additionally, it has been widely accepted that the hyper-medial structure of the Web can support learning. Some researchers characterize the Web as an active learning environment that supports creativity. In addition to this, the Web encourages exploration of knowledge and browsing, behaviors that are strongly related to learning. The associative organization of information in the Web is similar to that of human memory, and the process of information retrieval from the Web presents similarities to human cognitive activities (Tselios, Avouris, Dimitracopoulou, & Daskalaki, 2001). However, a hyper-medial space, like the Web, cannot be considered, only by these features, as an effective tutoring environment. It is rather more appropriate to think of the Web as a powerful tool that can support learning, if used in an appropriate way. This is because learning is a process (Duchastel, 2001) that depends on other features, such as learner's motivation, previous experience and learning strategies that the individual has been supported to develop, and so forth. Effectiveness of any educational environment cannot be considered independently of these aspects.

USABILITY VS. LEARNABILITY

To define the notion of "learnability", we must first answer the question, "what makes the (instructional) content of an environment easily learned?" The answer to this question defines in general the learnability of the environment. A more formal definition attempt would be the statement that it is *the set of the methods, the modes and the tools of the environment, which facilitate the acquisition of knowledge*. This work assumes that the notion of learnability embeds de facto the notion of the communication channel; it is impossible for someone to gain knowledge if the environment lacks the means to offer it. So, an evaluation of the learnability of the environment, evaluates hence the success rate of the established communication channel. Continuing on, the next question that emerges is the relation between usability and learnability and in how far one affects the other, which is a central question in this chapter. In more detail, we are interested if a usable environment facilitates the acquisition of knowledge, or, the opposite, if a less usable environment sets certain obstacles. And finally, this question transits to the question if one can heuristically assess the learnability of an educational environment. Heuristic evaluation, as described initially by Nielsen and Molich (1990) and following by Nielsen (1993), is a well-established, expert-based interface evaluation method for the evaluation of the usability of a particular interface. A set of interface experts is asked to judge the interface, based on a set of a few criteria, the heuristics.

What do we mean by the term "usability"? According to ISO-9241 (ISO, 1998) standard, we have the following definition:

Usability of a system is its ability to function effectively and efficiently, while providing subjective satisfaction to its users.

Usability of an interface is usually associated with five parameters (ISO, 1998; Nielsen, 1993), derived directly from this definition:

1. *Easy to learn*: The user can get work done quickly with the system;
2. *Efficient to use*: Once the user has learned the system, a high level of productivity is possible;

3. *Easy to remember*: The casual user is able to return to using the system after some period without having to learn everything all over again;
4. *Few errors*: Users do not make many errors during the use of the system or if they do so they can easily recover them; and
5. *Pleasant to use*: Users are subjectively satisfied by using the system; they like it.

To conclude, when the synergy between usability and learnability occurs, the use of the software can be thought of as "integrated", in that a seamless union develops between the use of the software and the learning process (Squires & Preece, 1996).

THE EDUCATIONAL EVALUATION

The evaluation methodologies applied in the field usually utilize questionnaires in the classroom, however most questionnaires embody closed-type questions, so they lack the opportunity to clarify some other aspects that could be of interest, have an impact on the environment and on the involvement of the software on learning. Moreover, closed-type questions do not take into consideration the individual differences of the students in learning. In general, quantitative approaches to evaluate an educational environment have been strongly debated as monosemantic approaches that must be supplemented by qualitative ones, which focus on *how* and *what* the student learns.

Other studies in the research field of the evaluation of a distance learning environment are the studies of Holmberg (1977), Saba and Shearer (1994), and Garrison (1993), however none of them deals absolutely in the field of evaluation of Web-based environments, as it is in the case of Makrakis, Retalis, Koutoumanos, and Skordalakis (1998) and Koutoumanos, Papaspyrou, Retalis, Maurer, and Skordalakis (1996). These are all user-based evaluation approaches, since they utilize more or less questionnaires that have to be answered by users.

THE HEURISTIC EVALUATION

Concerning the expert-based approaches, Jacob Nielsen and Rolf Molich (1990) started their research in 1988, and in 1990 they presented the "heuristic evaluation". The basic point was the reduction of the set criteria to just a few, at the same time being broadly applicable and generally agreed; simultaneously augmenting the evaluators' expertise, and consequently their reliability. These "heuristic rules" or "heuristics" derived from studies, criteria lists, field observations and prior experience of the domain.

The core point to evaluate in the initial approach is the usability of the interface. Based on the ISO principles about usability (ISO, 1998), Nielsen (1993) stated the following heuristics, slightly modified and reorganized by us:

1. Simple and natural dialog and aesthetic and minimalistic design;
2. Visibility of the system status – provide feedback;
3. Speak the users' language: match between system and real world;
4. Minimize the users' cognitive load: recognition rather than recall;
5. Consistency and standards;
6. Flexibility and efficiency of use – provide shortcuts;
7. Support users' control and freedom;
8. Prevent errors;
9. Help users recognize, diagnose and recover from errors with constructive error messages; and
10. Help and documentation.

The method refers mainly to traditional formative human-computer interface evaluation, yet a number of studies (e.g., Instone, 2000; Levi & Conrad, 1996) have proven its easy adaptability to the evaluation of Web sites as well.

LEARNABILITY HEURISTIC LIST

The next step one must perform is the construction of the heuristics for learnability. A good starting point provides the socio-constructivist view of instruction. Some studies in the field (e.g., Kordaki, Avouris, & Tselios, 2000) argue that an expert evaluator cannot predict the students' performance, although he/she can assess heuristically the learnability of the environment, however with mediocre results. The authors base their claims on the constructivist approach for open learning environments, also known sometimes as microworlds.

Squires and Preece (1999) proceed one step further: They do not make a combination, but a fusion of the Nielsen's heuristics with the five socio-constructivist learning criteria (credibility, complexity, ownership, collaboration and curriculum) providing thus a new list, which they claim to be a versatile tool to predictively evaluate educational pieces by their usability and simultaneous learnability.

1. Match between designers' and learners' mental models;