T. Hirashima et al. (Eds.) (2011). Proceedings of the 19th International Conference on Computers in Education. Chiang Mai, Thailand: Asia-Pacific Society for Computers in Education

Understanding Learners' Differences for Designing Educational Multimedia Interfaces

Ahmed Al-HUNAIYYAN [a*], Rana Al-HAJIRI [b], Salah Al-SHARHAN [c] & Nabiel Al-HUWAIL [d]

[a]*Computer Department, College of Business Studies, PAAET, Kuwait.*
[b]*Computer Department, Institute of Communication and Navigation, PAAET, Kuwait.*
[c]*Computer Science Department, Gulf University for Science and Technology, Kuwait.*
[d]*Computer Department, College of Business Studies, PAAET, Kuwait.*
[*]hunaiyyan@hotmail.com

Abstract: A significant use of Multimedia Based Learning within schools and universities across the world give rise to concern about learners' differences in performance and interaction style in these environments. The computer human interaction (CHI) environment regularly researches factors that affect the success or failure in interaction with computers. Designers need to construct meaningful frameworks for making appropriate decisions regarding visual design and user interaction. Many research studies are engaged in finding ways to build a computer-learning environment that can accommodate the different levels of learners' needs and abilities. This paper concludes that understanding individual differences of learners and learner's characteristics will undoubtedly help designers to provide effective educational programs, in which users can acquire knowledge that will meet their individual needs, resulting in improved learning performance in multimedia computer based learning environments. In addition, The paper suggests that in any e-learning adoption must match learners' expectations in order to keep them motivated and attracted to the system.

Keywords: HCI, Interface Design, Educational Multimedia, Usability**.**

1. Introduction

Learners' performance, perception, and their ability to comprehend learning materials are determined by their varying skills and abilities. In other words, some users may need more explanations than others. In hypermedia, learners are allowed to learn in their own ways and to make their own paths through the material. In this way, they learn things at their own pace and construct their understanding of subject matter actively. It is important that instructors are easily able to recognize information resources that match user's needs. In addition, user's should have a flexible interface that accommodates their individual preferences, learning styles.

2. Individual differences

Learners may have different backgrounds, especially in terms of their knowledge, skills, and needs, so they may show various levels of engagement in course content. Therefore, many studies argue that no one style will result in better performance. However, learners whose browsing behavior was consistent with their own favored styles obtained the best performance results. Previous studies by Chen and Macredie [2], demonstrated the

importance of individual differences as a factor in the design of computer-based learning. Such individual differences have significant effects on user learning in multimedia computer-based learning. The sections bellows discuss individual differences of learners such as cognitive styles; gender differences; prior knowledge; and culture.

2.1 Cognitive Styles

Cognitive style refers to the preferred way individual's process information. Multimedia and hypermedia learning systems provide users with freedom of navigation that allows them to develop learning pathways. Much empirical evidence indicates that not all learners can benefit from these systems. In particular, some learners have problems dealing with non-linear learning. Research into individual differences by Ford and Chen [4] suggests that a learner's cognitive style has considerable effect on learning in multimedia systems.

2.1.1 Field-Dependent versus Field-Independent

Field dependence (FD) and field independence (FI) refers to an analytical or global approach to learning, and is probably the most well-known division of cognitive styles. FI learners generally are analytical in their approach, whereas FD learners are more global in their perceptions. Many experimental studies have argued the impact of FD and FI on the learning process, Ford and Chen [3].

2.1.2 Holist versus Serialist Strategy

A study by Chen and Macredie [2], two versions of a hypermedia learning system, the Breadth-first and the Depth-first, were designed with program control paths. In the Depth-first version, each topic was presented in detail before the next topic, which was presented in the same way (i.e., Serialist condition). The material was classified into seven depth levels. In contrast, the Breadth-first version provides a summary of all of the material prior to introducing detail (i.e., Holist condition), and included 12 categories in breadth. Results showed that users whose cognitive styles were matched to the design of hypermedia learning systems that they preferred achieved higher posttest scores. Field Dependent learners performed better in the Breadth-first version than in the Depth-first version.

2.1.3 Visualized versus Verbalized

Visualizer and Verbalizer emphasizes the presentation of information. Since multimedia systems incorporate numerous ways to present information, such as text, graphics, sound, animation and video, multimedia content was found to significantly influence users' levels of understanding and enjoyment. According to Jonassen and Grabowski [5], the main differences between the two cognitive styles, Visualizers and Verbalizers, is that a Visualizer prefers to receive information via graphics, pictures, and images, whereas a Verbalizer prefers to process information in the form of words, either written or spoken. Visualizers prefer to process information by seeing, whereas Verbalizers prefer to process information by listening and talking.

2.2 Learner's Gender

Gender differences are also argued as an important factor that significantly impacts learning in hypermedia learning systems. Studies show that, in general, females have less experience with computers than males. Thus, females tend to experience more disorientation in hypermedia than males [1], and males have been found to outperform females [4].

2.3 Prior knowledge

Learners with different levels of prior knowledge, from experts to novices, benefit differently from hypermedia learning systems. According to Simmons and Lunetta [7], a novice can be defined as someone having little or no formal training/experience in the area examined, whereas an expert can be defined as a learner with formal training and experience in the area under investigation.

2.4 Learner's Culture

Designers of multimedia interfaces should be aware of the cultural features of the program in which it is important to have a mechanism to understand the cultural elements of the target user. These mechanisms are needed not only to provide "good" cultural multimedia interfaces to learners across multiple cultures, but also to serve as tools for users of a specific culture. It is important to understand the difference between what is comprehensible to a culture and what is acceptable, Russo and Boor [6]. Because social norms, values, and traditions vary greatly between cultures, what is acceptable in one culture can be objectionable in another. One of the design principles in any interactive multimedia application is to understand the relationship between the various visual elements of the intended application and how multimedia programs can accommodate "culturally diverse" users. This is accomplished by seeking users' perceptions of the presentation aspects of an interface.

References

[1] Chen, S. & Ford, N. (1998). Modeling user navigation behaviors in a hypermedia-based learning system: An individual differences approach. *International Journal of Knowledge Organization*, *25*(3), 67-78.

[2] Chen, S. Y. & Macredie, R. D. (2002). Cognitive styles and hypermedia navigation: Development of a learning model. *Journal of the American Society for Information Science and Technology*, *53*(1), 3-15.

[3] Ford, N. & Chen, S. (2000). Individual differences, hypermedia navigation, and learning: An empirical study. *Journal of Educational Multimedia and Hypermedia*, *9*(4), 281-311.

[4] Ford, N. & Chen, S. (2001). Matching/mismatching revisited: An empirical study of learning and teaching styles. *British Journal of Educational Technology*, *32*(1), 5-22.

[5] Jonassen, D. H. & Grabowski, B. L. (1993). *Individual Differences and Instruction*. New York, Allen & Bacon.

[6] Russo, P. & Boor, S. (1993). How fluent is Your Interface? Designing for International Users. *Proceedings of INTERCHI' 93, International Conference of Human Factors in Computing Systems*, Amsterdam, the Netherlands, April 24-29. IOS Press.

[7] Simmons, P. E. & Lunetta, V. N. (1993). Problem-solving behaviors during a genetics computer simulation: Beyond the expert/novice dichotomy. *Journal of Research in Science Teaching*, *30*(2), 153-173.