The design and the formative evaluation of a web-based course for simulation analysis experiences

Yu-Hui Tao [a,*], Shin-Ming Guo [b], Ya-Hui Lu [c]

[a] *Department of Information Management, National University of Kaohsiung, Kaohsiung, Taiwan, ROC*
[b] *Department of Logistics Management, National Kaohsiung First University of Science and Technology, Kaohsiung, Taiwan, ROC*
[c] *ASE Testing Electronic Co., Kaohsiung, Taiwan, ROC*

Abstract

Simulation output analysis has received little attention comparing to modeling and programming in real-world simulation applications. This is further evidenced by our observation that students and beginners acquire neither adequate details of knowledge nor relevant experience of simulation output analysis in traditional classroom learning. With the advances in the Internet learning environment, web-based computer-based training (CBT) can efficiently and effectively enhance the traditional classroom learning. This research addresses the issue of designing a web-based CBT course to assist the classroom instruction in helping students learn better simulation problem solving. The goal is to provide an effective way to learn the implicit experience of simulation output analysis via an efficient interactive environment. A prototype asynchronous web CBT system with simulation analysis guidelines was built to verify our design through a three-stage formative usability evaluation. The results showed that the simulation analysis guidelines organized by this research significantly improved the test scores and the interactive CBT system maintained students' interests longer than the written format.
© 2004 Elsevier Ltd. All rights reserved.

Keywords: Computer-based training; Formative evaluation; Simulation analysis; Web-based course; Tacit knowledge

---

* Corresponding author.
  E-mail addresses: ytao@nuk.edu.tw (Y.-H. Tao), smguo@ccms.nkfust.edu.tw (S.-M. Guo), sonia_lu@email.asetest. com.tw (Y.-H. Lu).

1. Introduction

Computer simulation has been an important skill for a seasoned professional in operation research/management science (OR/MS) (Dyer, Bean, Dewald, Gepfert, & Odoni, 1993) and a critical OR tool in the industry (Nelson, Bradbard, Ledbetter, & Cox, 1987). A typical simulation process includes formulation, programming, verification, validation, experiment design and analysis, and recommendations (Taylor & Hurrion, 1988a, 1988b). Shannon (1985) estimated that one needs to receive "at least 720 h of formal class instruction plus another 1440 h of outside study" to acquire the basic simulation tools. This does not include the extra effort required to gain real-world experience in order to acquire proficiency.

Students in related fields usually take only one simulation course. Due to time constraints in classroom settings, learning computer simulation is often limited to simulation concepts, modeling and programming (Lu, 2000; Rohrer & Banks, 1998). Consequently, simulation design and analysis is simplified and receives a lower priority. The situation is further evidenced by our observation that most students consider simulation design and analysis a much more difficult topic. However, a successful simulation application depends heavily on the effectiveness of simulation statistical analysis. Thus, efficient learning of effective simulation statistical analysis merits more research.

Computer-based training (CBT) has been widely applied in learning after the burgeoning popularity of personal computer in the eighties. According to the survey of Whitehouse and Pellegrin (1995), utilizing personal computer and software to raise the knowledge of students can save up to 70% of training time. Recent popularity of Internet has brought more benefits into traditional CBT learning, such as the 24×7 availability, better interactions between students and instructors, and virtual classroom space. Accordingly, an asynchronous web-based CBT system can serve as an after-hour teaching assistant to traditional classroom learning.

Because the tacit knowledge of experiential simulation analysis is not included in major English textbooks, nor are these simulation-related CBT systems currently available to the public to our knowledge, the objective of this research is to explore the design of a web-based CBT system that can assist the beginners to study effective simulation analysis experience in an efficient way. The remaining paper is organized as follows: literature review in Section 2, research design and scope in Section 3, prototype system design in Section 4, and evaluations and conclusions in Section 5.

2. Literature review

A web-based CBT system on tacit knowledge is not common both in practice and in literature. Newman and Lamming (1995) indicated that the usability is the key for an interactive system design while Tao (1999) pointed out that the experience as well as the theory is required for learning proficient simulation analysis. Therefore, to meet the objective of such a CBT system design, we review the content of experiential simulation statistical analysis, the concept of interactive system design, and the characteristics of web-based CBT as follows.

2.1. Content of experiential simulation statistical analysis

Teaching both the knowledge and the experiences of simulation statistical analysis are required to help novice acquire effective problem-solving skills (Tao, 1999). Tao (1999) also pointed out