INFOSCI **INFORMATION SCIENCE PUBLISHING** ITB14482
701 E. Chocolate Avenue, Suite 200, Hershey PA 17033-1240, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.igi-pub.com

This paper appears in the publication,
The Knowledge Medium: Designing Effective Computer-Based Educational Learning Environments
by G. Berg © 2003, IGI Global

Chapter V

Human-Computer Interaction in Education

This chapter seeks to understand aspects of Human-Computer Interaction (HCI) research relevant to education. The general study of human-machine interaction began in World War II with a focus on understanding the psychology of soldiers interacting with weapon and information systems such as signal detection and cockpit instrument displays. After the war, human-machine interaction began to be examined more broadly in relationship to work and consumer product environments. Human-computer interaction developed from this work and is a multi-disciplinary field involving computer science, psychology, engineering, ergonomics, sociology, anthropology, philosophy, and design. HCI is concerned with the design, evaluation, and implementation of interactive computing systems for human use (Card, Moran & Newell, 1983; Faulkner, 1998; Head, 1999; Helander, 1998).

The subject of HCI has been assigned various labels and acronyms over the years. The acronym is generally used to mean human-computer interaction, but sometimes is described as human-computer interface. Additionally, CHI, or computer-human interaction, is sometimes used, as well as MMI, man-machine interface. The primary focus of HCI is the user—the field as a whole tries to better understand the interactions between the user and computer. The primary factors

considered in examining human-computer interactions are organizational, environmental, cognitive, task, constraints, and functionality (Faulkner, 1998; Head, 1999; Maddix, 1990; Preece & Shneiderman, 1995).

Cognitive research and principles developed in the 1980s provided much of the early HCI framework (Faulkner, 1998). The literature on HCI focuses in part on cognitive processes, especially in terms of the capacities of users and how these affect users' ability to carry out specific tasks with computer systems. In contrast to behaviorism, which argues that action must be understood in terms of observable behavior between humans and the environment, cognitive psychology focuses on mental processes sometimes expressed in computational terms (Wooffitt, Fraser, Gilbert & McGlashan, 1997). In terms of cognitive issues, HCI concentrates on motor, perceptual, and cognitive systems and two types of memory: working and long-term. According to Card, Moran and Newell (1983), the most effective technique for retaining information is to associate it with something already in long-term memory. Thus, much of this literature on the cognitive aspects of HCI is concerned with the relationship between long- and short-term memory. One might draw parallels here to Piaget's learning theories and concepts of accommodation and assimilation. Accordingly, memory is broken down into the following aspects: processor cycle time, memory capacity, memory decay rate, and memory code type. Obviously, these cognitive issues have special importance for educational applications. How can computer applications best make use of memory attributes to increase learning?

HUMAN FACTORS

HCI is a subset of the field of human factors that also includes interface design, system/user communications, and end-user involvement (Carey, 1991; Reisner, 1987). Human factors as a field is defined by Carey (1991) as "the study of the interaction between people, computers, and their work environment" (p. 2). The objective of human factors research is to create information systems and work environments that help to make people more productive and more satisfied with their work life. However, the overall emphasis of human factors is on system performance, not on human satisfaction. Today, most computer and software companies have human factors staff (Helander, 1998), and Shneiderman (1987) claims that the diverse use of computers is stimulating widespread interest in human factors issues. He points to five primary human factors: time to learn, speed of performance, rate of errors by users, subjective satisfaction, and retention over time. All of these factors are central to learning—and here one can see how closely learning theory parallels human factors research.