

Chapter 1

Human Cognition in the Design of Assistive Technology for Those with Learning Disabilities

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ABSTRACT

This is the first of three chapters serving as the introduction to this handbook which addresses the relationship between human cognition and assistive technologies and its design for individuals with cognitive disabilities. In this chapter the authors introduce the human information processing system. They discuss the modal model of memory, a basic framework offering the most popular explanations behind the active processes used in the construction of new knowledge. In doing so, the authors examine the three memory stores comprising the modal model which are responsible for the acquisition, storage, and retrieval of information. The authors then discuss ways in which to increase learning. Altogether, they present the approach that technology for learning should be created with an understanding of design principles empirically grounded in the study of how the human mind works, particularly when it comes to the design of assistive technologies for individuals with learning disabilities.

INTRODUCTION

The Case for Human Cognition in the Design of Assistive Technology for Those with Learning Disabilities

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and since amended and replaced with the Assistive Technology Act of 1998, *assistive technology* (AT) has been formally defined as “any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities” (United States Congress, 1998, Definitions and Rule section, para. 3). Although we typically think of technologies such as wheelchairs and prosthetics to help those with

physical impairments, ATs can also have a significant impact on the lives of those with cognitive disabilities. If created with the abilities and deficits of those with cognitive disabilities in mind, ATs can remove obstacles and offer individuals greater independence which they might not otherwise be able to experience. Likewise, the opposite is also true. Assistive technologies created without an understanding of the cognitive disabilities of individuals can become a hindrance. Unlike that of AT, the mere act of defining the term “cognitive disability” has proved troublesome.

The Broad Nature of Cognitive Disabilities and Our Focus on Learning Disabilities

Definitions for the term “cognitive disability” vary by source. Generally speaking, a *cognitive disability* is any disorder which affects mental processing. There are different severities of cognitive disabilities. Individuals with severe disorders may need uninterrupted assistance and supervision by caregivers in almost every aspect of daily life, whereas individuals with minor cognitive disabilities may require very little if any assistance. In fact, some cognitive disabilities may be so minor that they are never diagnosed (Rogers, 1979).

Our Focus on Learning Disabilities

In this three chapter introduction we focus on cognitive disabilities which impair learning. Specifically, children, adolescents, and adults diagnosed with *learning disabilities* (LDs). We refer to children, adolescents, and adults because LDs are considered to be lifelong disorders. Children with LDs will someday grow up to become adults with LDs. Their brains are not defective or damaged. Instead, they see, hear, and understand things differently. Learning disabilities are thought to be neurological in nature and are related to central

nervous system dysfunction (National Joint Committee on Learning Disabilities, 1991).

This brings up an important point. Learning disabilities should not be used as a measure in which to gauge intelligence. Individuals with LDs have average or above average intelligence, but have difficulty with rudimentary skills that those without LDs take for granted. Learning disabilities are typically considered to be less severe cognitive disorders which can manifest themselves in many different forms. Reading disabilities (dyslexia), writing disabilities (dysgraphia), and math disabilities (dyscalculia), are probably the most recognizable LDs owing their mainstream familiarity to the media and other public channels.

BACKGROUND

What are Learning Disabilities?

There have been a myriad of efforts to define LDs. The need for a definition has stemmed from the fact that without one, LDs cannot be clearly recognized and measured for the purpose of diagnosis and remediation (Wong, Graham, Hoskyn, & Berman, 1996). As you might imagine, obtaining consensus among professionals and policy makers within the LDs community has been difficult. In fact, some efforts have ignited fierce debates, such as the 2004 reauthorization of the U.S. Individuals with Disabilities Act (Fletcher, Lyon, Fuchs, & Barnes, 2006). Although varying definitions continue to exist among professional organizations and government agencies (see Wong et al., 1996, for an in-depth review), a definition that appears to have captured the essence of LDs and received the broadest endorsement in the LDs community (Hammill, 1993, as cited in Wong et al., 1996) is the one by the National Joint Committee on Learning Disabilities (NJCLD) (1991), which reads:

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