Chapter 5.5
Cognitive–Adaptive Instructional Systems for Special Needs Learners

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ABSTRACT

This chapter provides a perspective on the problems, challenges, and unique opportunities faced by instructors and designers of information technology in helping students who are differently-abled learn more effectively in online environments. The proposed solution is provided in the form of a cognitive-adaptive instructional system. This system provides menu-driven adaptive options or online assessments that evaluate a student's cognitive and sensory needs. These needs are translated into cognitive-sensory profiles, which are linked to compensatory and remedial actions. These actions render content automatically and dynamically in ways that provide adaptations that compensate for a student's special-needs while complementing their strengths.

CHAPTER OBJECTIVES

This chapter should help the reader:

- Better understand the nature and extent of the problems faced by special needs learners
- Better understand the interrelationships between cognitive and sensory impairments and their potential impact on participation in online learning communities
- Understand the importance of integrating adaptive instructional capabilities into online instructional models
- Understand the key technical concepts underlying the cognitive-adaptive instructional system and identify potential applications

INTRODUCTION

Recent decades have seen significant advances in the design and implementation of hardware and software for delivering online and computer-assisted instruction. Educational applications of information technology are increasingly integrated into a diverse array of devices, from personal digital assistants and cell phones, to laptop and desktop computers. They are deployed in a dizzying variety of forms, ranging from broadband distance learning to CD-based instruction and digital textbooks. Information technology is increasingly the primary instructional vehicle for a number of application areas including basic skills training in companies, educational telemedicine, military training, and, of course, the delivery of K-12 and college curricula.

At the same time that this technological infrastructure is developing, our understanding of the pedagogy of online and computer-assisted instruction is rapidly increasing. As a result, more and more individuals participate successfully in innovative learning environments that are partially or wholly computer-based and increasingly delivered online. As we learn more about how students learn online, we can develop increasingly sophisticated and effective instructional models to inform and guide more effective instructional information system design. One population at risk in this new digital learning environment is students who have inherited or acquired cognitive and sensory impairments. These impairments may interfere with a student's ability to access and learn subject matter in both traditional and in digital information rich environments. These special needs students will challenge our ability to translate educational and cognitive remediation theory into practice and into the design of more intelligent online educational technology systems.

Therefore, the goal of this chapter is to provide a context and rationale for the need to develop and use adaptive instructional systems in order to help students, especially those with learning disabilities (LDs) or deficiencies in basic skills or academic achievement, to learn more effectively. In order to achieve the goal of providing effective online instruction to diverse user populations, a cognitive-adaptive instructional system that uses adaptive hypermedia is proposed. The ways in which this system can be used to accommodate a diverse range of cognitive and sensory impairments and skill deficiencies will be described. In explaining how this system can be implemented, new Web-based information technologies will be discussed. In addition, examples of online applications of adaptive models will be provided in order to demonstrate that such a practice-based system can help meet the learning needs of special students.

BACKGROUND

Special needs individuals at risk in digital learning environments are of all ages and at all developmental stages. They become cognitively "differently-abled" due to the effects of aging, accidents (e.g., traumatic brain injury), disease, or specific developmental or inherited neurological conditions. Many of these individuals are often left behind in traditional classroom environments. The failure to provide for their information processing and learning needs in online and other digital environments will only widen an educational and social participation gap that already threatens their full inclusion in 21st century life. If we do not address the problems and special needs of such differently-abled users, we will help promote the development of a generation of digitally disenfranchised individuals who are not able to participate equitably in technology-mediated educational, cultural, social, and economic communities. The effectiveness with which issues relating to the accessibility and utility of digital environments by the differently-abled are addressed will critically impact the role that information technology will play for these populations now and in the future.

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