Chapter 60
Web-Based Experimentation for Students with Learning Disabilities

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ABSTRACT

Assistive technologies can go a long way in helping learning disabled students to keep-up with their classmates. The ubiquity of internet as an active social networking, communication, and education platform has opened up a wide range of new possibilities for web-based lectures and experimentation that can be used to assist learning disabled students. To this end, the authors developed and applied Automated Internet Modeling (AIM) Lab dedicated to semiconductor device modeling and characterization. Their lab has been extensively used for teaching courses on semiconductor devices at senior and graduate levels. Recently, AIM-lab incorporated additional functionality such as You-Tube compatible on-line video feeds, audio and visual collaboration with peers via web-messaging in order to meet the needs of learning disabled students and make their learning process more effective. In this chapter, the authors focus on recent advances in the development of remote experimentation labs in the context of engineering education with an emphasis on general technological issues and specific experiments offered. Systematic evaluation of educational benefits derived from using these labs will also be presented.

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INTRODUCTION

Challenges in Learning Disability Education

The number of students with Learning Disabilities (LD) has grown rapidly in last 20 years, there were about 783,000 children in the US identified with LD in 1976 and in 1992 the LD population has grown to approximately 2.3 million in U.S. (Swanson, 2000). Learning disability disorder can be classified by one or more psychological processes involved in understanding or in using spoken or written language. The disability may manifest itself as an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and development aphasia may lead to LD (Lerner & Kline, 2005). Each year about 120,000 students are identified as LD in U.S.; they comprise almost 50% of all placements into special education (U.S. Office of Education, 1994).

As an example, Figure 1 illustrates percentage of LD students with hyperactivity disorder in the United States. As a result, increasing numbers of LD students are attending colleges. Enrollment increases of these students in two-year and four-year post-secondary colleges can be attributed to better academic preparation, improved transition planning, and increased availability of federal monies for LD scholarships and model programs (Brinckerhoff, McGuire, & Shaw, 2002). Despite this progress, the retention and degree completion rates of LDs in postsecondary education have not followed the same trajectory, with many students dropping out during their first year (Belch, 2004; Horn, Berktold, & Bobbit, 1999; Stodden, 2001). Their failure at the college can be related to inadequate academic preparation (Horn, Berktold, & Bobbit, 1999), lack of transition support between high school and college (Frieden, 2004), fragmentation and inconsistency in service provision (Frieden, 2004), a lack of teaching staff knowledge for dealing with LD and the absence of appropriate accommodation and modifications (Malakpa, 1997; Villarreal, 2002). All these factors play a crucial role in LD students learning experience with one of the most important being teaching staff-student relationship. A recent study of 86

Figure 1. Diagnosed attention deficit hyperactivity disorder and learning disability (United States, 2004-2006 http://www.cdc.gov/ncbddd/adhd/data.html)