Chapter 21
Integrating Accessible Multiplication Games into Inclusive Classrooms

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ABSTRACT

Two accessible games were the focus of a study involving inclusive fourth grade classrooms in a suburban Chicago elementary school district. The games were created using software with universal design capability and were designed to teach multiplication facts. Data were collected that compared the classes using the software with classes that did not use the software. The statistical analysis used in the design of the study was analysis of covariance using a pretest assessment of multiplication facts as the covariate. Students used the games twice a week for four weeks during a period of 40 minutes a day. Results indicated a gain in accuracy of multiplication facts on the part of the groups using the games, but not enough to demonstrate significance. In addition to the analysis of covariance analysis, selected classes filled out surveys designed to measure the students' opinions of the games and their effectiveness. Results of the surveys indicated that the students were somewhat unsure about their effectiveness as a tool to learn multiplication facts but found them enjoyable to play. Interpretation of both of these results is provided.

INTRODUCTION

Several recent educational initiatives have resulted in the inclusion of students with disabilities in standards-based instruction and standardized assessments (Anderson & Anderson, 2005). Standards-based instruction developed primarily during the 1990s when national teacher organizations developed academic standards. Students with disabilities became increasingly involved with standards-based instruction and assessment, culminating in the passage of the Individuals with Disabilities in Education Act of 1997 that required students with disabilities be included in standardized assessments (Bottsford-Miller, Thurlow, Stout, & Quenemoen, 2006). The passage

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of No Child Left Behind (2001) further required that not only must students with disabilities be included in standardized assessment, but the law also demanded successful results by these students. This movement has made it necessary for the field of education to develop a system for making curriculum universally accessible for all students, including those with disabilities. Indeed, the most recent iteration of the Individuals with Disabilities in Education Act (H.R. 1350, 2004) advocates that instructional materials be developed using principles of universal design.

Technology is a useful tool in assisting in the development of universally designed curriculum. Several software tools have been developed with the intent of promoting an accessible curriculum. This study took advantage of the accessible authoring capabilities of one of these tools, Intellimathics (2003), to create and study the effectiveness of two multiplication games that were developed and used in four inclusive fourth grade classrooms.

BACKGROUND

In 1983, the publication of *A Nation at Risk* (National Commission on Excellence in Education, 1983) led to a national push for accountability in teaching. In 1989, President George H.W. Bush and the governors of the 50 states developed a set of national educational goals that would become the Goals 2000: Educate America Act (H.R. 1804). This act required greater accountability based on higher academic standards. Professional teacher organizations in each content area set out to develop their own lists of standards, designed to be the backbone of standardized assessment development and the foci of each field in its attempt to develop future problem-solving workers. Individual states, in the meantime, adapted and adopted these lists of academic standards into their own under the direction of the Goals 2000 initiative and with the assistance of the initiative's funding (Anderson & Anderson, 2005).

At the same time, the field of special education began to question its effectiveness and its parallel programming as being too separate from general education (Wang, Reynolds, & Walberg, 1988, Behrman, 1992). The resulting self-questioning led to a movement towards inclusion of students in the regular classroom (Fuchs & Fuchs, 1994), requiring that the education of students with disabilities become a joint responsibility between general education and special education. As inclusion progressed, students with disabilities were also increasingly included in standardized assessments, culminating in the passage of Individuals with Disabilities in Education Act of 1997, requiring that all students with disabilities be included in all standardized assessments with the exception of the bottom two percent of those identified as disabled who were required to be assessed in an alternate capacity using the states' academic standards. No Child Left Behind (2001) finalized the process, declaring that special education is a subgroup of those students taking standardized assessment who are also required to be achieving acceptable levels in reading and writing by 2013-14 (Anderson & Anderson, 2005).

A recent development that benefits both the inclusion movement and the high stakes assessment movement for students with disabilities is the initiative called universal design for learning. This movement, named after the architectural initiative called universal design, involves changing teaching methods and materials to make them accessible for all students including those with disabilities (Rose & Meyer, 2002). Universal design for learning may or may not take advantage of technology. However, many software developers and researchers are taking advantage of the characteristics offered by technology to help make teaching accessible for all, including standardized assessments. Examples of universal design for learning include: enabling text to speech synthesis so that materials can be read by the computer (Lance, McPhillips, Mulhern, & Wylie, 2006), including links in documents to graphic organiz-