# Chapter 5.6
# Animated Computer Education Games for Students with ADHD:
## Evaluating Their Development and Effectiveness as Instructional Tools

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## ABSTRACT

Children and adolescents with Attention Deficit Hyperactivity Disorder (ADHD) have difficulty maintaining attention, controlling their activity level, and they typically demonstrate poor interpersonal relationships skills. Because of their challenges, educational performance tends to suffer. Paradoxically, when seated in front of a videogame or computer program they enjoy, the performance of individuals with ADHD becomes similar to non-ADHD peers. The purpose of this chapter is to present a conceptual framework for understanding the factors that affect the outcome of individuals with ADHD, and to demonstrate how instructional design models can be used to guide the design and implementation of animated computer education games as instructional tools for this population. Specifically, the FIDGE model and Gagné's Nine Events of Instruction are evaluated for their contributions to understanding the unique technological needs of the ADHD learner.

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## INTRODUCTION

Current estimates indicate Attention Deficit Hyperactivity Disorder (ADHD) affects 4% to 12% of U.S. children (Froehlich et al., 2007). Longitudinal studies suggest children who are diagnosed with ADHD continue to have difficulties with organization, time management, impulsive thoughts and actions, stress management, emotional regulation, interpersonal relationships, and academic skills such as reading, studying, and test taking as adolescents and as young adults (Barkley, Fischer, Smallish, and Fletcher, 2006). Children and adolescents with ADHD often struggle in

traditional classrooms. Many fidget and have difficulty remaining in their seats, thus causing disruption to the classroom as well as to the child's own education. Even when children with ADHD are able to sit quietly, they often require multiple repetition in order to retain information they hear. Most teachers cannot pause to emphasize each individual fact to a child with ADHD while the rest of the class has grasped the material and moved on. As a result, adolescents with ADHD are more likely to drop out of high school and fail to complete college compared to their non-ADHD counterparts. Lower educational achievement often leads to underemployment, poor social adjustment, and decreased overall quality of life. To address these problems, a more engaging and personalized education format is necessary for children and adolescents with ADHD.

According to DuPaul and Stoner (2003), students with ADHD are educated more effectively if multiple mediators (peers, computers, and parents) are involved. They also recommend the intervention strategies be individualized particularly since the ADHD population is heterogenious. According to the Centers for Disease Control and Prevention (September 2, 2005), 56% of all children ages four to 17 years diagnosed with ADHD were taking stimulant medications. Though medication is the most widely used treatment for ADHD, a combination of self-monitoring and self-reinforcement may have longer lasting effects. Barkley, Copeland, and Sivage (1980) found this combination improved task-related attention, academic accuracy, and peer interactions. DuPaul, Rutherford and Hosterman (2008) suggested the use of self-monitoring and self-reinforcement particularly at the secondary level because there are fewer opportunities for this age group for token reinforcement, contingency contracting, or response cost.

Technological advances and the increased availability of technological resources afford most schools the ability to incorporate different types of instructional technology into the classroom. For students with ADHD, educational tools that involve computerized technology offer a wider range of options for learning. The benefits of computerized presentation of information include the use of multiple senses, the breakdown of material into smaller pieces, provision of immediate feedback, and the limitation of unnecessary, distracting features (DuPaul & Weyandt, 2006). According to several studies, children and adolescents with ADHD are more attentive to computerized programs or interventions than to traditional instruction methods (Shalev, Tasal & Mevorach, 2007; Farrace-Di Zinno et al., 2001; Carroll & Bain, 1994). They also seem to respond better to interactive instruction than when they serve in more passive roles as listeners or viewers (Shaw & Lewis, 2005; Klingberg et al., 2005). Shaw, Grayson & Lewis (2005) found students with ADHD performed better and were more engaged by information presented in a game format than by regular computerized instruction. In addition, Farrace-Di Zinno et al. (2001) observed how students with ADHD were more similar to their peers without ADHD with regard to the amount of motor movement and distractability during computer video game play.

According to Fister (1999), computer games can be used for primary learning of different subjects rather than just for review and reinforcement. Ota and DuPaul (2002) evaluated the effects of a game-based math software program on the performance of ADHD students. They found increased math performance, decreased off-task and disruptive behavior, and increased active engagement in the computer-based instruction compared to the traditional classroom lesson. Mautone, DuPaul, and Jitendra (2005) found similar math improvements in ADHD students. Oral reading fluency has also been the target of research using computer-assisted technology with ADHD students. Clarfield and Stoner (2005) found improvements in oral reading fluency and subsequent engagement in the activity when a computer-assisted reading program was used. While data suggest students with ADHD may