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Research Foundation

*Access 21st Century*

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Many students who have been identified as struggling learners, including those identified as at-risk for school completion, have identifiable deficiencies in content area knowledge and cognitive strategies important for academic functioning (Lenz, 1991). These students have further been described as deficient problem solvers and information processors, having poor self-concept, as well as having attentional problems and motivational deficiencies. *Access 21st Century* is a computer-assisted instructional solution that provides a bridge toward successfully remediating these deficiencies.

There are a number of important considerations involved with deploying a computer-assisted instruction (CAI) program as a tool for teaching and differentiating instruction:

- Students should be given opportunities to apply already learned skills within a meaningful context.
- Computer instruction should foster active involvement and stimulate thinking.
- Students should be able to monitor their own learning and progress.
- Computer instruction should make use of content from a wide range of subject areas.

In addition to these critical components of robust, computer-assisted instruction, *Access 21st Century* applies the self-directed learning principles proposed by Knowles (1975) for the effective teaching of adolescent and adult learners. These principles include:

- diagnosing learner needs,
- formulating learning needs,
- identifying resources for learning,
- choosing and implementing appropriate learning strategies, and
- evaluating learning outcomes.

*Access 21st Century* delivers a standards-aligned curriculum in language arts, writing, mathematics, social studies, and science as well as graphic representations of information that span across content areas such as the ability to interpret graphs, charts, and tables. This knowledge base enhances skills in critical thinking, decision making, problem solving, and communication. The *Access 21st Century* instructional design gives students the opportunity to obtain the proficiency necessary to enable them to master academically challenging content and become successful learners.

*Access 21st Century* employs a version of the micro-adaptive, response-sensitive, diagnostic-prescriptive instructional approach described by Park and Lee (2003). This adaptive methodology focuses learners on those areas in need of remediation and “adapts” or adjusts the instructional level and the amount of skills practice based on their individual interaction with the program. This design is highly motivational because it minimizes student frustration and efficiently manages time on task, which in turn, leads to improved outcomes.

*Access 21st Century* builds on a well-documented research foundation establishing the impact of computer-assisted instruction on a variety of learners. Several studies have attempted to quantify the effectiveness of computer-assisted instruction. Kulik and Kulik (1991) conducted a meta-analysis of computer-assisted instruction across both elementary and secondary grade levels and found an effect size of .30 in support of CAI. Kulik, Bangert, and Williams (1983) reported an average effect size of .32 for students in grades 6 through 12 that used microcomputers to learn course content. Other syntheses of studies conducted with school age students (Kulik, Kulik, & Bangert-Drowns, 1985) have yielded effect sizes of .47, supporting the efficacy of computer-assisted instruction. Additionally, Park and Tennyson (1986) indicated that response-sensitive adaptive programs have the potential to enhance the effectiveness of CAI.

One of the strongest findings in the research literature is that the use of computer-assisted instruction as a supplement to traditional teacher-directed instruction produces achievement

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effects superior to those obtained with traditional instruction alone. Stennett (1985) found that CAI practice significantly improved student achievement. Researchers have also found that, as well as enabling students to achieve at higher levels, CAI enhances learning rates. Studies of CAI instruction have revealed a 40% faster learning rate than with conventional instruction, and delayed retention tests show superior retention rates for CAI students over traditional instruction (Capper & Copple, 1985; Kulik & Kulik, 1987). Salomon and Gardner (1986) concluded that varied forms of information technology do not control or affect learners' performance and cognition in any deterministic way, but rather, learners affect their own performance, particularly when given opportunities in which they can interface with interactive educational conditions with computers equipped with sophisticated software.

Personal computers have been found to be particularly effective in the areas of academic gains, problem solving, and higher motivation in reading, writing, and mathematics with students that are at risk for school failure (Bialo & Sivin, 1990; Braun, 1993), and for students who are learning English as a second language (Ormes, 1992). Researchers have also found that the advantages of computer-assisted instruction in school settings are beneficial to a variety of different types of learners. These benefits include one-to-one individualized assistance, self-pacing, positive reinforcement, and motivation in drill-and-practice activities (Schiffman, Tobin, & Buchanan, 1984). In addition, concept understanding, higher-order thinking, and strategic knowledge have been enhanced through the use of personal computers (Hasselbring, Gottge, & Goin, 1992). Hannaford (1993) found that students with mild disabilities and at risk for school difficulty tended to learn more academic content more thoroughly in less time with computer-assisted instruction, and the use of personal computers seems to result in increased attention, motivation, and time on task for all students, including those at risk of academic failure. Reading comprehension for students identified as at risk, remedial, or disabled from elementary through senior high school has also been improved with CAI (Higgins, 1990; Higgins & Boone, 1992; Tobias, 1987).

Computer-assisted instruction can have a clear-cut impact by improving the quality and efficiency with which a lesson is delivered, by providing access to tools that ease the burden of completing an instructional task, by making needed information and assistance immediately accessible, or by providing explicit prompts to help students use meta-cognitive strategies. Examples include grammar and spell checks, availability of a dictionary and thesaurus, cut and paste capabilities, prompted writing activities, writing coaches, as well as keyboard and other friendly features of the computer environment itself. Other effects of instructional technology use include the fact that students tend to be more highly engaged when they use CAI; their time on task increases with CAI; students get pleasure from the use of CAI; and their motivation for completing tasks increases.

Computer-assisted instruction can also affect students' performance outside the immediate context in which it is used by helping students generalize, or transfer, what they have originally learned in the lesson. Student motivation to learn and their view of themselves as learners have also been enhanced as a by-product of CAI; improved self-concept and more adaptive attributions for success and failure have also been noted in the literature. According to Okolo, Bahr, & Rieth (1993), these effects have received far less attention in the CAI literature because they are more difficult to demonstrate. Nevertheless, they have significant implications for the impact of CAI on students' achievement.

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