Computerized Drill-and-Practice and Academic Attitudes of Learning Disabled Students

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Abstract

Computerized drill-and-practice is currently a primary application of microcomputers in special education. This application has been disparaged by some, but in many cases has been demonstrated effective in improving the academic skills of learning disabled (LD) and underachieving children. This investigation found that 126 LD students who received computerized math and spelling drill-and-practice for a year expressed significantly more positive attitudes toward academic work on the computer than toward similar academic tasks undertaken in the regular classroom. They also reported opinions significantly more favorable toward math and spelling drill than opinions expressed by 89 other learning disabled students, who did not have access to computerized math and spelling instruction, toward academic work performed in their special education classrooms. Analysis by gender of student revealed that boys were significantly less positive about school than girls but that boys and girls were equally positive about practicing academic skills on the microcomputer. It was concluded that computerized drill-and-practice may be more effective than once believed and that additional research is needed to identify the components of computerized drill-and-practice that result in academic and attitudinal gains among learning disabled pupils.

More than 1.2 million microcomputers are currently used in American schools, and it has been estimated that microcomputers are installed in approximately 96% of all public schools ("Computer Use . . . ," 1987). The most rapid increase of educational microcomputers has occurred in elementary schools (TALMIS, 1984), and microcomputer use in special education classrooms has increased proportionately (Becker, 1986).

The substantial growth in educational mi-

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crocomputer use has been accompanied by a vigorous debate concerning the appropriate instructional application of computers to special education (Watkins & Webb, 1981). Hummel and Balcom (1984) endorsed the micrcomputer as a data management and word-processing tool for special education students. Hofmeister (1982) noted that the primary contribution of microcomputers to special education may occur through computer literacy and computer-managed instruction. Bright and Harvey (1984) listed the benefits of computer games as instructional devices. Weir and Watt (1981) extolled the use of Logo, a computer language, to enhance basic skills and develop problem-solving abilities in learning disabled pupils.

At present, the primary application of microcomputers in special education is computer-assisted instruction (CAI) of the drill-and-practice type (Becker, 1983; Maddux, 1984). Computerized drill-and-practice has been equated with worksheets and reviled as an inefficient application of microcomputers (Golden, 1986; Haven, 1985; Reinhold, 1986; Slesnick, 1986). Nevertheless, CAI drill-and-practice has been shown to have a positive effect on the achievement of elementary school children (Kulik, Kulik & Bangert-Drowns, 1985) as well as learning disabled and underachieving students (Bellotti, 1985; MacLachlan, 1984; McDermott & Watkins, 1983; Mevarech, 1985; Mevarech & Rich, 1985; Millman, 1984; Trifiletti, Frith, & Armstrong, 1984; Watkins, 1986; Watkins & Webb, 1981).

Although the idea runs counter to intuition, positive attitudes and high achievement may not be strongly related (Schofield, 1982). Clark (1982) noted that students often report enjoying the instructional method from which they learn the least. Schofield (1981) concluded that there is a degree of incompatibility in maximizing both cognitive and affective outcomes in children. However, there is preliminary evidence to suggest that a computer learning environment has the potential to reverse this trend and improve both learning and academic interest (Hyson, 1985; Millman, 1984; Perez & White, 1985). The possibility of a shift toward more positive attitudes in conjunction with academic remediation is especially important for learning disabled students (Kavale & Glass, 1982), who may not be actively involved in the learning process (Gettinger & Fayne, 1982; Kavale & Forness, 1986). This investigation was conducted to assess the influence of computerized drill-and-practice on the attitudes of learning disabled (LD) students.

METHOD

Subjects

The entire population of 215 learning disabled elementary school students enrolled in a southwestern suburban school district served as subjects in this investigation. Students were diagnosed as learning disabled by certified school psychologists based upon state guidelines requiring, among other criteria, a significant discrepancy between ability and achievement. Mean WISC-R full scale IQ was 93.2 (SD = 12.33) and mean grade placement was 3.75 (Md = 4, SD = 1.50).

Nineteen special education teachers in seven elementary schools provided services to these 215 learning disabled pupils. More than 96% of these students were Caucasian. Twelve special education teachers teaching in five different schools volunteered to administer an attitude survey to their 126 LD students (88 male, 38 female) who had, throughout the year, regularly used mathematics and spelling CAI drill-and-practice in their special education classrooms. The other seven special education teachers, who taught in three different elementary schools, administered the same attitude survey to their 89 learning disabled students (60 male, 29 female) who had not been exposed to CAI because they did not have access to microcomputers. CAI and non-CAI students did not significantly differ in IQ or grade placement by group or by sex.

Materials and Procedure

The CAI software used to deliver drill-and-practice during the school year was *The Math Machine* (Watkins, 1981a) and *The Spelling Machine* (Watkins, 1981b). These programs use a variable ratio positive reinforcement system to

consequate successful performance, multiple skill levels to match district curricula, and record-keeping and management systems to allow teachers to monitor and direct student progress. This software provided students with informational feedback on each response, but did not allow students to control content. *The Math Machine* and *The Spelling Machine* have been demonstrated to increase the academic skills of this group of learning disabled students (McDermott & Watkins, 1983; Watkins & Webb, 1981) as well as LD students from other parts of the country (Bellotti, 1985; MacLachlan, 1984; Millman, 1984).

Student attitudes were gathered with the Student Attitude Survey, a locally developed, unstandardized scale. Items were dictated by teachers to eliminate error attributable to inadequate reading skills. CAI students responded to five items while non-CAI students answered three items. Both groups responded to each item by marking one of five hierarchical pictorial stimuli (ranging from a frowning face to a smiling face). Attitudes were quantified by converting student responses on each item to a scale of 1 to 5, where 1 was most negative and 5 most positive.

RESULTS

Student Attitude Survey average item scores for CAI and non-CAI groups by gender are provided in Table 1 and a frequency table of survey item responses is presented in Table 2. It is apparent from a review of Table 1 that CAI boys and girls were equally positive about the computer in general (item 4) as well as about using the computer for academic drill-and-practice and for games (items 3b and 5). Related t tests indicated that non-CAI students were significantly more positive about academic work in their special education classrooms than they were about regular classroom academics, t (88) =1.93, $p < .05$ (see Table 3), while CAI students preferred academic drill-and-practice on the computer to academic tasks in their regular classrooms, t (125) = 6.135, $p < .0001$ (see Table 4).

A group (CAI vs. non-CAI) by sex (boys vs. girls) analysis of variance was applied to survey items 1, 2, and 3. Two significant effects

TABLE 1
Average student attitude survey item scores by group and sex

Item	CAI Male	CAI Female	Non-CAI Male	Non-CAI Female
1. I like school.	3.81	4.11	3.62	4.19
2. I like doing math & spelling in my regular classroom.	3.78	4.18	3.61	3.66
3a. I like doing math & spelling in my special education classroom.	—	—	3.83	4.41
3b. I like doing math & spelling on the computer.	4.66	4.66	—	—
4. I like the computer.	4.82	4.82	—	—
5. I like playing games on the computer.	4.89	4.84	—	—

TABLE 2
Frequency of student attitude survey item responses by group

Item	Rating 1	2	3	4	5
1. I like school.					
CAI	11	10	13	39	53
Non-CAI	12	2	15	22	38
2. I like doing math & spelling in my regular classroom.					
CAI	9	11	17	35	54
Non-CAI	12	6	16	24	31
3a. I like doing math & spelling in my special education classroom.					
Non-CAI	12	0	11	17	49
3b. I like doing math & spelling on the computer.					
CAI	3	0	9	13	101
4. I like the computer.					
CAI	0	0	3	17	106
5. I like playing games on the computer.					
CAI	1	1	2	5	106

TABLE 3
Analysis of variance summary for CAI and non-CAI boys and girls on question 1

Source	*MS*	*df*	*F*	*p*
CAI	.126	1	.074	.786
Gender	8.549	1	5.001	.026
CAI × Gender	.849	1	.496	.482
Error	1.709	211		

TABLE 4
Analysis of variance summary for CAI and non-CAI boys and girls on question 2

Source	*MS*	*df*	*F*	*p*
CAI	5.592	1	3.317	.07
Gender	2.249	1	1.334	.249
CAI × Gender	1.405	1	.833	.362
Error	1.686	211		

emerged: Girls expressed more favorable opinions of school in general (item 1) than did boys (F (1, 211) = 5.001, $p < .03$) (see Table 5) and CAI students displayed more positive attitudes toward academic drill-and-practice on the computer (items 3a vs. 3b) than did non-CAI students for academic work in their special education classrooms (F (1, 211) = 11.16, $p < .001$) (see Table 6).

Thus, CAI and non-CAI learning disabled students held relatively equivalent attitudes toward school and academic tasks in their regular classrooms. The between-group equivalence indicated that learning disabled students preferred special education classroom work to regular class tasks and, in turn, were more positive about computer drill-and-practice than about special education classroom work.

As an independent validity check, computer-using teachers were asked to rate their students' willingness to do math and spelling drill on a microcomputer versus their willingness to engage in academic activities used prior to installation of microcomputers. All 12 teachers reported that students' willingness to perform academic work was "better" or "much better" on the computer.

TABLE 5
Analysis of variance summary for question 3a versus question 3b for CAI and non-CAI boys and girls

Source	*MS*	*df*	*F*	*p*
CAI	12.885	1	11.157	.001
Gender	3.777	1	3.271	.072
CAI × Gender	3.809	1	3.298	.071
Error	1.155	211		

DISCUSSION

Students often report enjoying the instructional method from which they learn the least (Clark, 1982). Learning disabled students require effective academic remediation, but also must develop more positive academic attitudes (Kavale & Glass, 1982). This research considered whether computerized drill-and-practice could provide one solution to this instructional dilemma. In this investigation, CAI drill-and-practice students expressed significantly more positive attitudes toward academic work on the computer than toward similar academic tasks undertaken in the regular classroom. CAI students also reported significantly more favorable opinions toward math and spelling drill than did non-CAI students to academic work performed in their special education classrooms. These results support the hypothesis that computerized drill-and practice has the potential to improve both academic performance and attitudes of LD students.

Boys were significantly less positive than girls about school in general, but boys and girls were equally positive about using the computer to practice academic skills. These findings parallel those reported by Swigger, Campbell, and Swigger (1983), who found that preschool boys and girls spent equal free-choice time on the computer. Watkins and Abram (1985) reported, contrary to what is usually found in most conventional programs (Bank, Biddle, & Good, 1980), that boys performed as well as girls on a reading test following reading CAI. When considered in this context, there appears to be some evidence that CAI is differentially effective for improving the academic performance and attitudes of young boys. Given the preponderance of males in learn-

ing disabilities classrooms (Norman & Zigmond, 1980), this possibility is especially promising for special education.

This investigation used a limited sample of learning disabled students and drill-and-practice software. Results cannot be confidently generalized to the larger LD population or to all drill-and-practice software. They do reveal, however, that drill-and-practice delivered by microcomputers may be more effective than sometimes thought and suggest that additional research should be conducted to identify the components that result in improved learning and positive attitudes among learning disabled students.

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