

Special Learners Included Through Computers in Education (SLICE)

Struggling Reader Research Study

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STRUGGLING READER RESEARCH STUDY

Special Learners Included through Computers in Education (SLICE) is a computerized educational system that allows printed text to be converted into electronic text, and then spoken aloud by a computer. This technology has a plethora of potential applications, including support for learners who have difficulty with written language (e.g., dyslexic students, ESL, or LEP students). SLICE provides online access to digitized versions of school textbooks, novels, or other instructional material that teachers may assign, and via the web, students view a written image of the text online while the computer reads the material aloud to them through headphones. In the spring of 2004, schools were invited by mail and internet notification to participate in a research project using SLICE as part of their summer school programs for middle and high school students. Any struggling reader with an average IQ and scoring below the 50th percentile in reading was eligible to participate. A selection of "classic novels" (public domain) was made available via the internet and students were asked to read for at least one hour each day in 15 minute blocks of time using a 30 day trial download of text-to-speech software.

During the research study, some of the schools used SLICE to complement an existing summer school curriculum which required students to read with classroom computers in the school. Other schools used SLICE as their only summer school program. Students at these schools were expected to read with computers at home or in the city library. All student reading activity was tracked remotely to monitor how long, how often and what each student read. Testing material was provided for teachers, who were directed to administer pre-tests before students began reading with the technology and post-tests within one month after the end of the program. The following four research questions guided the research study.

Research Questions

1. Does SLICE technology help improve reading skills for those students ineligible for special education services?
2. Did students who were classified as eligible for Title 1 services have significantly higher posttest achievement scores than did those students who were identified as not eligible for Title 1 services?
3. Did students who were classified as ESL have significantly higher posttest achievement scores than did those students who were identified as non ESL?
4. Did SLICE have differential effects on students of different ethnicity groups?

Methodology

Sample

The total number of students participating in the summer program was 42. Students were classified in terms of their identification as eligible for Special Education services (SPED), their poverty level (Title 1 status), their use of English as a second language (ESL), and their ethnicity (Native American and Other).

Instruments

The Gates-McGinitie measures reading ability and is a timed multiple-choice test, group administered, and has known reliability and validity estimates. It was completed by all students as the pretest and the posttest measures.

Procedure

At the beginning of the summer program, teachers administered the Gates-McGinitie to all students in the program, regardless of their classification. Throughout the summer, students accessed SLICE technology and used it on average for 10 sessions. At the end of the summer

program, all students also participated in posttesting, which consisted of the same Gates-McGinitie test completed at the beginning of the summer.

Results

To focus specifically on students who were ineligible for SPED services, two paired *t*-tests were performed. The first paired *t*-test used the vocabulary pretest and posttest as the dependent variable and included only those students ineligible for SPED services, regardless of their status on other variables including Title 1, ESL, Poverty, or Grade. The total number of students in this sample was 28. Further subdividing the sample by the other variables (e.g., ESL, Title 1) would have further reduced the sample size, thus limiting the ability to complete statistical tests. Results indicated significant differences between pretest and posttest scores for both the vocabulary [$t=2.246, p=.033$] and the comprehension [$t=3.105, p=.004$] tests. Students ineligible for SPED services had significantly higher vocabulary and comprehension scores at the end of the summer (14.62 and 22.38, respectively) than they did at the beginning of the program (11.98 and 17.93, respectively).

Pretest Analysis

Comparisons were also made between groups of students to identify potential differential effects of SLICE. The comparisons included analysis of pretest scores, posttest scores, and gain scores. The four comparison groups included SPED, ESL, Title 1, and Ethnicity. Due to the lack of methodological controls for the study (e.g. random assignment to group, matching subjects), pretest data were examined to identify any initial differences in reading scores between groups of subjects. The four categories included in the analyses included SPED, Poverty, ESL, and Ethnicity. A series of Multivariate Analysis of Covariance (MANCOVAs) were conducted using the four groups of students as the independent variables, pretest comprehension and

vocabulary Normal Curve Equivalent (NCE) scores as the dependent variables and grade level as the covariate. Results indicated there were no significant differences in the pretest scores for the SPED [$F(2,38)=.221, p=.803$], ESL [$F(2,38)=.304, p=.739$], and Poverty [$F(2,38)=1.03, p=.366$] groups. There were significant differences, however, for the Ethnicity variable [$F(2,38)=4.43, p=.019$]. In this analysis, students classified as “Other” ($M=15.7$) scored significantly higher ($ES=+0.86$) on the vocabulary pretest than did those classified as “Native Americans” ($M=10.8$). There were no significant differences between the two groups on the comprehension pretest.

Posttest Analysis

Given that significant differences did exist on the pretest, both comprehension and vocabulary pretest scores were used as covariates in the analysis of posttest scores. A series of four MANCOVAs were conducted using vocabulary and comprehension posttest scores as the dependent variables; SPED, Poverty, ESL and Ethnicity as independent variables; and pretest (comprehension and vocabulary) scores and grade as the covariates. Results indicated no significant difference in posttest scores for the SPED [$F(2,36)=.619, p=.544$], Poverty [$F(2,36)=1.85, p=1.72$], ESL [$F(2,36)=2.66, p=.084$], or Ethnicity [$F(2,36)=1.66, p=.204$] variables. These results suggested that there were no differences between any of the four groups at the end of the program, while there was a significant difference between students at the start of the program.

Gain Score Analysis

Gain scores of students participating in the program were the focus of the next series of analyses. A series of four MANCOVAs were conducted using Gain scores (based on NCEs) as the dependent variables, grade as the covariate, and SPED, Poverty, ESL, and Ethnicity as the independent variables. Results indicated no significant differences for SPED [$F(2,38)=.623,$

$p=.542$], Title 1 [$F(2,38)=2.08, p=.139$], ESL [$F(2,38)=2.72, p=.079$]. There were, however, significant differences for the Ethnicity variable [$F(2,38)=3.64, p=.036$]. Follow-up tests indicated no significant differences on the comprehension gain scores [$F(1,39)=.461, p=.501$], but there were significant differences on the vocabulary gain scores [$F(1,39)=7.35, p=.010$]. Native American students had significantly higher gain scores than did students classified as “Other” ($ES= +1.02$).

Summary and Conclusion

SLICE was designed to support learners who have difficulty with written language and to foster academic success in the general curriculum. The sample in this study included students in multiple categories, including SPED, Poverty, ESL, and Ethnicity.

The first research question specifically asked if those students who were ineligible for SPED services improved their reading skills during the summer program. Results of two paired t-tests indicated that at the end of the program, non-SPED students scored significantly higher on the vocabulary and comprehension posttests than they did on the pretests. Comparisons were then made between SPED and non-SPED students to determine if there were differential effects of SLICE. Results indicated that both groups began the summer program with essentially the same test scores, gained at the same rate throughout the summer, and ended the summer program with essentially the same scores, thus SLICE benefited both groups equally.

The remaining research questions addressed the effects of SLICE on students classified via Title 1, ESL, or Ethnicity. Analysis of pretest scores for the full sample of students participating in the summer program indicated that pretest differences existed only for the Ethnicity category, with Native American students scoring significantly lower on the vocabulary

pretest than did those classified as “Other.” This indicates that Native American students began the summer program at a relative deficit to students classified as “Other.”

Throughout the summer, students in the program had access to SLICE technology and used it on average for approximately 10 sessions. Analysis of posttest scores indicated no significant differences in any of the SPED, Poverty, ESL, or Ethnicity groups. This indicates that any significant differences on the pretest were eliminated throughout the course of the summer program. This was verified by analysis of gain scores. Although Native American students began the summer at a significant deficit on the vocabulary test, their gain scores on the vocabulary test were significantly higher than were those of students classified as “Other,” resulting in no significant differences by the end of the program.

In summary, students who were ineligible to receive SPED services used SLICE throughout the summer program and made significant gains on both the vocabulary and comprehension tests. Comparisons of these students with those who were eligible to receive SPED services revealed that students in both groups began the summer program at the same level, gained in vocabulary and comprehension scores at the same rate, and ended the summer program at essentially the same higher level. The effects of SLICE seem to be equally powerful for both groups of students.

Students classified as Title 1, ESL, or higher poverty also seemed to be equally benefited by participation in the SLICE summer program, beginning the summer with essentially the same scores, making the same gains, and ending the summer with the same posttest scores. For Native American students however, the effects of SLICE seem to be especially beneficial. Although Native American students began the summer with significantly lower scores on the vocabulary test, they made significantly higher gains and ended the summer program with posttest scores at

the same level as did students classified as “Other.” The gains made by Native American students during the summer were sufficient to eliminate the deficits with which they began the summer program. Given these encouraging results, it is recommended that additional students participate in SLICE to determine if these results will generalize to larger populations of students.