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Computer Use Helps Students to Develop Better Writing Skills

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ISSUE BRIEF

Computer Use Helps Students to Develop Better Writing Skills

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A decade ago, schools used computers almost exclusively for computer literacy training and for tutorial instruction in basic skills. Today, students use school computers most often as word processing and reference tools.[1] A recent review of controlled evaluations of instructional technology in elementary and secondary schools finds that this use of computer tools for writing and reference helps students to develop better writing skills.

The review, *Effects of Using Instructional Technology in Elementary and Secondary Schools: What Controlled Evaluations Say*, discusses findings both from controlled evaluation studies published since 1990 and from findings in earlier reviews.[2] The report looks separately at effects of word processor use, computer writing prompts, and computer enrichment programs. The review finds that effects of computer use are positive in each area, but it also cautions that the improvements due to computer use, although statistically significant in most studies, are nonetheless small in many cases.

Like most recent reviews on technology applications in education, *Effects of Using Instructional Technology* employs effect-size measures to summarize findings. An effect size specifies the number of standard deviation units that separate outcome scores of experimental and control groups. Effect sizes are positive when the experimental group in a study outperforms the control group and negative when the control group comes out on top. Cohen, a pioneer in the use of effect sizes in the social sciences, classified effect sizes of around 0.2 as small, 0.5 as moderate

[1] Becker, Henry J., Ravitz, Jason L., and Wong Yan-Tien. 1999. *Teacher and Teacher-Directed Student Use of Computers and Software*. Report #3. Irvine, CA: University of California, Center for Research on Information Technology and Organizations.
[2] Available at http://www.sri.com/policy/csted/reports/sandt/it .

in size, and 0.8 as large.[3] Slavin, an expert in educational evaluation, judged effect sizes above 0.25 to be large enough to be considered educationally and practically significant.[4]

From Tutor to Tool

No single study provides a definitive account of how students have been using computers in schools over time, but surveys conducted by Becker and his colleagues during the past decade provide important data on the shift in use of school computers in recent years.[5]

- In their 1999 survey, Becker and his associates asked teachers to specify their main objectives in having students use computers. The objective chosen by most teachers (51%) was to have students find out about ideas and information. The next most popular objective was to help students express themselves in writing (44%). Thus, teacher objectives emphasized reference work and word processing. In response to questions in Becker's 1991 survey, teachers said that they most often used computers for basic skills training and computer literacy.

- Becker and his associates asked teachers in their 1999 survey to identify the categories of software that their students were using in school. About 50% of all teachers reported that their students were using word processing software. Reference software appeared to be the next most popular software category. About 36% of teachers reported student use of CD-ROM software, and about 36% reported use of Web browsers.

- Becker and his associates also asked teachers in 1999 to name the software packages that they considered to be most educationally valuable for their students. In 1999, the program most widely viewed as valuable was ClarisWorks (now AppleWorks), an integrated office application. Other programs singled out by teachers as especially valuable included another integrated office application (Microsoft Works), a word processing program (Microsoft Word), and a Web browser (Netscape).

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[3] Cohen, Jacob. 1977. *Statistical Power Analysis for the Behavioral Sciences (Revised Edition)*. New York: Academic Press.

[4] Slavin, Robert E. 1991. "IBM's Writing to Read: Is It Right for Reading?" *Educational Evaluation and Policy Analysis* 13(1):1–11.

[5] Becker, Henry J., Ravitz, Jason L., and Wong Yan-Tien. 1999. *Teacher and Teacher-Directed Student Use of Computers and Software*. Report #3. Irvine, CA: University of California, Center for Research on Information Technology and Organizations. Also Becker, Henry Jay. 1991. "How Computers Are Used in United States Schools: Basic Data from the 1989 I.E.A. Computers in Education Survey." *Journal of Educational Computing Research* 7(4):385–406.

All indications therefore are that the primary uses of computers in schools today are as writing and reference tools.

Word Processing

When the word processing revolution first showed signs of moving from the workplace to schools, educators began speculating about its possible effects on students. Although some educators thought that these effects would be negative, advocates argued that they would be positive because young writers would be able to produce, revise, and edit text more easily on word processors. Young writers using word processors would be able to manipulate text physically without laboriously copying and recopying it. With regular use of word processors, young writers might even get into the habit of revising and reorganizing their compositions, and this habit might affect the quality of their writing even when they were writing with paper and pencil alone.

Studies that examined word processing effects on writing skills began to appear in the education literature during the 1980s, and in 1993, Bangert-Drowns wrote a meta-analytic review of these studies.[6] The review cited 32 studies in which one group of students wrote compositions with word processors while a second group of students wrote with paper and pencil. The studies were conducted in elementary and secondary schools as well as in postsecondary institutions.

Twenty of the studies contained quantitative information on overall quality of writing. In 13 of the studies, the students who wrote with word processors produced higher quality compositions, but in 7 studies, the students who wrote with paper and pencil produced the better compositions. Median effect size in the 20 studies was 0.21. Bangert-Drowns reported that this average effect size was significantly different from zero, but it is nevertheless a small effect.

Bangert-Drowns's collection of 32 studies included five studies with quantitative data on composition length. In each of the five studies, compositions written on word processors were longer than compositions written with paper and pencil. Median effect size in the five studies was 0.36. Seven of the studies in Bangert-Drowns's collection examined effects of word processors on student attitudes toward writing, and seven examined effects on writing conventions. Bangert-Drowns found no consistent effects of word processing on these two outcome measures.

[6] Bangert-Drowns, Robert L. 1993. "The Word Processor as an Instructional Tool: A Meta-Analysis of Word Processing in Writing Instruction." *Review of Educational Research* 63(1):69–93.

About half of the studies in Bangert-Drowns's collection examined effects in elementary and secondary settings and half examined effects in colleges. Results in elementary and secondary studies were somewhat stronger than results in college-level studies. The median effect size was 0.28 in the 10 precollege studies of writing quality; the median effect size was 0.10 in the 10 college-level studies.

Effects of Using Instructional Technology examined four additional studies on word processing effects. The four studies were published during the past decade. The first study examined effects on sixth graders; the second, on eighth graders; the third, on middle school students; and the fourth, on fifth graders. The duration of the studies ranged from three weeks in the shortest study to one year in the longest.

In three out of the four studies, word processing produced significant positive effects on student writing skills. In the remaining study, however, writing with word processors had a significant negative effect on student writing skills. The median effect in the four studies was to increase student writing skills, as measured by ratings of quality of their compositions, by 0.30 standard deviations, equivalent to an increase from the 50^{th} to the 62^{nd} percentile.

For two decades, then, evaluation studies have been reporting that students who use word processors for writing compositions demonstrate superior writing skills in later follow-up tests of writing skills. Still, word processing effects were usually not dramatic in size. In a typical study, word processor use raised writing scores by around 0.3 standard deviations, equivalent to an increase from the 50^{th} to the 62^{nd} percentile. In addition, an increase in writing skills was not an inevitable effect of word processor use. Overall, schools have usually, but not always, helped students to develop better writing skills by teaching them to write with word processors.

Computer Writing Prompts

Researchers have modified standard word processing programs to give students writing prompts while the students are composing. The prompts may focus on writing mechanics, or they may provide guidance in development of new ideas. In his 1993 review of word processing research, Bangert-Drowns described two studies that suggested that these processing-plus-prompting programs might be more useful in instruction than standard word processing programs were. Both studies found positive effects from prompting, and Bangert-Drowns concluded that prompts could amplify the benefits of ordinary word processing.

Effects of Using Instructional Technology reported results from two additional studies on this topic. The studies were carried out during the last decade in a middle school and a high school. In one of the studies, students who received unsolicited prompts wrote better essays than control students did, but students who received prompts only when they asked for them performed at the same level as control students did.[7] In the second study, students received prompts only when they asked for them and did not improve in writing skills as a result of prompting.[8] Together, the studies suggest that the effectiveness of writing prompts may depend on how the writing prompts are presented. Prompting seems to be effective when students receive unsolicited writing prompts, but prompting seems to be ineffective when students must ask the computer for prompts. Clearly, more research is needed to build understanding of the phenomenon.

Computer Enrichment

In recent years, student access to computers has increased dramatically, and writing experts have taken a new look at computer effects on writing. Instead of focusing exclusively on efficiency of writing with word processors, writing experts are now looking at the degree to which computers increase the amount of written communication in schools. They note that in a computer-rich environment, students have more opportunities for authentic writing. They may communicate more in writing with peers and teachers at their schools, and they may also communicate more in writing with those in other schools. Some experts believe that the ultimate payoff from this enhanced experience of writing in the real world will be an improvement in the quality of student writing.

The most widely publicized program of computer enrichment is the Anytime Anywhere Learning (AAL) program of the Microsoft Corporation and Toshiba.[9] This program supports schools in their efforts to provide students and teachers with laptop computers that can be used at any location and at any hour of the day. Inspired by an Australian program in which many schools provided laptop computers for teachers and students, the AAL program was set up with

[7] Zellermayer, Michal, Gavriel Salomon, Tamar Globerson, and Hanna Givon. 1991. "Enhancing Writing-Related Metacognitions Through a Computerized Writing Partner." *American Educational Research Journal* 28(2):373–91.
[8] Bonk, Curtis J. and Thomas H. Reynolds. 1992. "Early Adolescent Composing Within a Generative-Evaluative Computerized Prompting Framework." *Computers in Human Behavior* 8(1):39–62.
[9] Microsoft Corporation. 2000. "Laptop Learning: Anywhere Anytime Learning." Available at http://www.microsoft.com/education/aal/ .

52 schools in 1996. Within three years, the program grew to include more than 800 schools with 125,000 students in the United States.

During the 1970s and 1980s, evaluators seldom examined the effectiveness of programs of computer enrichment. A comprehensive meta-analytic review of instructional technology studies from the 1970s and 1980s located only five studies of computer enrichment—out of a total of 96 evaluation studies at the elementary and secondary school level.[10] These enrichment programs provided students with relatively unstructured exercises of various types—games, simulations, tutoring, and so on—to enrich the classroom experience and stimulate and motivate students.

Evaluators measured the effects of enrichment in the five studies on tests of reading or mathematics or both. In three of the studies, student test scores were lower in the group that worked in a computer-enriched environment. The median effect of computer enrichment in the five studies was to decrease posttest scores by 0.14 standard deviations. An effect size of –0.14 is equivalent to a drop in test scores from the 50th to the 44th percentile. These results may be of limited relevance to today's programs of computer enrichment because the computer-rich environments of the 1970s and 1980s did not include many of the resources available today, including World Wide Web resources, e-mail, and laptop computers.

Effects of Using Instructional Technology describes results of six studies of computer enrichment from the past decade.[11] The six studies were far from uniform in design. The group included investigations of effectiveness of both anytime-anywhere laptop programs and programs of extended Internet access. The common denominator of the six studies was their shared goal of improving writing skills by increasing student access to computer resources.

The results of the six studies suggest that computer enrichment programs do affect student writing skills. Five out of six studies found that writing skills improved as a result of computer enrichment. In the remaining study, computer enrichment had a small, statistically

[10] Kulik, James A. 1994. "Meta-Analytic Studies of Findings on Computer-Based Instruction." In Baker, Eva L. and O'Neil, Harold F., Jr., eds., *Technology Assessment in Education and Training*, pp. 9–33. Hillsdale, NJ: Lawrence Erlbaum Associates.

[11] National Science Foundation, Division of Science Resource Studies. 2000. "Implications of Information Technologies." Available at http://srsweb.nsf.gov/it_site/it/infotech.htm .

significant, negative effect on student writing. The median effect size of computer enrichment programs in the six studies was to raise writing scores by 0.34 standard deviations, equivalent to an increase in test scores from the 50th to the 63rd percentile.

Overall, studies from the past decade suggest that computer enrichment has positive effects on student writing. The effects are usually not large, but they are large enough to be considered statistically and educationally significant. Nonetheless, more evaluation studies are needed in this area. It is important to go beyond broad generalizations about computer enrichment to specific findings on which kinds of enrichment work best in which settings for which students.

Conclusion

Evaluation studies for two decades have examined effects of word processor use on student writing skills. Evaluation studies from the 1980s usually found that students who practiced composing on word processors were able to write better compositions afterwards. Evaluation studies from the last decade found similar results. Effects of word processing on student writing skills were not large in size, but they were large enough to be considered educationally meaningful.

Two studies from the 1980s found that word processing programs that contain writing prompts produce better results than ordinary word processing programs do, and two studies of writing prompts from the 1990s served to clarify this finding. Together, the four studies suggest that the value of writing prompts depends on the way in which the word processor presents the prompts. Unsolicited writing prompts seem to help students develop better writing skills, but prompts seem to be less effective when students must ask the computer for the prompts. However, more research is needed on this topic.

Evaluation studies of the 1980s found that programs of computer enrichment did not have positive effects on student learning. The failure to find positive effects may have been due to the limited enrichment the programs provided. Enrichment programs of the 1980s did not give students Web access, e-mail, or continuous access to computer resources from laptops. But the poor showing for these programs during the 1980s may also have been due to failures in evaluation design. Evaluators examined effects of computer enrichment on mathematics and reading tests rather than on student writing skills. Whatever the reason for the poor findings in the 1980s, the failure did not recur during the last decade. Studies from the last decade found that

computer enrichment programs have favorable effects on student writing skills. Like studies of word processing, effects were sometimes small, but the typical result was large enough to be considered educationally meaningful.