What Research Says to the School Library Media Specialist About:

COMPUTER-ASSISTED INSTRUCTION

by

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WHAT RESEARCH SAYS TO THE SCHOOL LIBRARY MEDIA SPECIALIST ABOUT COMPUTER ASSISTED INSTRUCTION

Today my task is to summarize what we know from research about computer assisted instruction and what these results mean to the school library media specialist. I looked at my speech as outlined in School Library Media Quarterly which I received about an hour before my plane left for Los Angeles and decided I had been a bit overenthusiastic about what could be covered in 20 minutes and still retain a little meat. I shall do what I can to condense what I have learned for you.

I have sought out for this talk every review of research I could find and have been happy to find some excellent meta-analyses. A meta analysis is a technique of combining the findings of many experimental studies. The reviewer takes the results of data analysis reported in the F table of each study and combines the experimental variance across studies. This technique was developed by Dr. Gene Glass at the University of Colorado and is one that has promise for our field once we get enough experimental studies in any one area to examine collectively.

The meta-analyses I found plus other research reviews covered computer assisted instruction for a number of different audiences. Today, I shall summarize the research for elementary and secondary students. Reviews for adults, college students and the military will be included in the appendix of this paper but touched on only very briefly in my remarks.

Before I begin with my remarks on elementary students, let me say that I will define any studies dealing with computers and learning as computer assisted instruction. I will do this out of convenience since there are so many terms for different applications of computers in education. Let us now begin with the research done with elementary students.

SUMMARY OF ELEMENTARY RESEARCH

Vinsonhaler and Bass reported in 1982 their summary of 30 experimental comparisons in ten schools. They concluded that CAI drill and practice was more effective than traditional instruction in raising standardized text scores.

Electronic Learning Laboratory at Columbia University reported in 1982 that student attention, defined as time on task, was higher with computers than it was in the classroom.

Ragosta and Jamison conducted their evaluative study for ETS in 1981. They evaluated the drill and practice curriculum of the Los Angeles Schools. Their findings indicated that CAI had a positive impact on computational math but not necessarily an additional increase in conceptual understanding. Language and reading results were not as positive as those in math. Gains were the greatest in the middle elementary grades.

Earlier, Hartley, in his meta-analysis of CAI done in 1977 found that CAI was one of the most effective ways of teaching mathematics in the elementary school. I think we must note that the 1977 year predates the emergence of the microcomputer. His review, therefore, is of large, mainframe applications.

Two other pre-micro reviews were found. One by Edwards, et al. and

Jamison, et al. Both found CAI to be an effective teaching tool - particularly for students who were below grade level.

ELEMENTARY AND SECONDARY STUDIES

I found five reviews which spanned both elementary and secondary schools.

Henry Becker at Johns Hopkins University is particularly active and has written a review and concept paper on computers and is currently publishing the results of a national survey of the uses of microcomputers in schools. In his later survey, the preliminary report shows that at the elementary level, " micros are largely employed as cost effective means of increasing the rate at which students learn the rules of arithmetic computation and proper English usage. Secondary schools, which have more microcomputers than elementary schools, tend to use their micros to teach students about computers and to teach them how to program in BASIC. So do elementary schools that have had computers for two or three years. There is a decline in the use of micros for drill and practice as programming teaching increases. Many teachers reported that the main impact microcomputers have had is social. More enthusiasm for schooling, a greater tendency for students to work without a teacher, and more instances of students helping each other were among the trends mentioned. As previous studies have shown, lower income public school districts are much less likely to have school microcomputers."

In another review published by Burns and Bozeman in 1981, we are warned that while CAI has been shown to be effective in teaching math, there are a host of variables to consider and control if we are to expect positive results.

Clement, in his review for Educational Technology in 1981 concentrated on the affective results of using CAI. He found that in general, student attitudes toward computer based education have been positive. Some of the reasons given are:

(1) self paced (time to absorb and comprehend the materials without inconveniencing another person)
(2) lack of embarrassment when mistakes are made (only my computer knows)
(3) immediate feedback (immediate knowledge that the answer is correct or incorrect)
(4) a general feeling that they learn better through the computer system.
(5) lack of subjective evaluations, i.e., the computer bases its evaluations strictly on student performance, not on personal characteristics or on the social relationship with the teacher.

SECONDARY STUDIES

Two reviews of research were located which dealt with only secondary students' use of CAI.

Kulik, et al. with whom's work I am impressed, performed two meta-analyses of CAI studies - one on the secondary level and the other on the college/adult level. In the secondary school review, his analysis of 51 experimental studies showed that students receiving CAI scored at the 63rd percentile in tests as compared to the 50th percentile for the "no CAI" group.

CAI improved retention and also the speed at which students learn. This was true across various subject matter. However, his analysis covered only drill and practice.

Thomas, in his "pre micro" review, 1979, affirms the power of computers as teaching tools and suggests that many CAI students gain mastery status in a shortened period of time.

If you will look at the college/adult research reviews in the appendix you will note similar findings. CAI usually produces small but significant gains in learning and does it in a shorter period of time than conventional instruction.

SUMMARY OF WHAT WE KNOW

1. Most of the research thus far has concentrated on drill and practice and much of the research has been done with large mainframe computers.

2. Most studies agree: computer assisted instruction is an effective teaching tool and possibly a little bit better than conventional instruction.

3. We can expect positive affective effects as children and young poeple interact with computers.

4. We can expect better time-on-task behavior and significant time savings when using CAI.

Those are the positive findings. In addition, Becker reminds us that there is a trend away from drill and practice applictions. This is interesting since almost all the research has been done for that application. It means that as we move away from drill and practice applications, we are doing so without a large body of research to guide us. Becker notes that the trend is toward the teaching of programming. So far, there is little research which shows the effect of programming skill on other educational skills.

As I look at the research, I have a feeling of deja vue. Every technology in education has been shown to affect learning positively; that is, children and young people learn, no matter what method is employed. That should not be surprizing to any school library media specialist. But over the years, we have seen a number of technologies come and go. At first the technology has been held up as a dynamic tool that might revolutionize education and then it has faded into obscurity as time has passed. The reasons for disappointment with technology are legion; however, failure is not usually due to the technology itself, but rather, our ability to use it.

We should realize that disappointment with microcomputers has already begun to set in. To quote the Wall Street Journal recently:
"A significant number of schools that have computers are not using them very effectively, if at all. Some computers sit on the shelf, and some teachers that originally had high expectations about the difference computers would make now feel mislead or disillusioned. The reasons for this situation vary. Some schools bought expensive hardware only to discover that it isn't what they really need and doesn't do what they thought it would. Some schools have computers but no money at all for software. Some have computers and software but no staff members with the information, guidance, and the experience necessary to use them and to work with students effectively. And so many

schools that have a computer, some software, and some experience are still asking themselves in frustration, 'What difference can a single computer possibly make to so many children?'"

I would like to point out that negative feelings toward technology in education may be rampant from time to time, but it is no more severe than criticism of teachers and their methods. I feel that three considerations merit our attention when considering the effectiveness of technology:

(1) We must not ask a technology to deliver more than it was designed to deliver.
(2) If we expect technology to deliver, we must utilize its potential wisely.
(3) We must reject poor materials and programs created for the technology and select only tested and proven software.

Sadly, we have many teachers who lack training in the use of educational technology. Too often, the teacher passes the subtle hint to students: "sit back and relax while this film entertains you," or, "I've taught you what's really important, technology will now provide supplemental or enriching experiences." Teachers should require as much or more attention while students use technology as when they are experiencing any other form of instruction.

I am confident that computers will have a lasting role in education. Their role in management of instruction, schools and library media centers is already assured and better programs and ideas for their use in teaching are emerging so rapidly that it is extremely difficult to keep up.

What can we do as school library media specialists to exploit computers - to squeeze out every bit of value as teaching tools?

Leiblum, in his excellent article published in AEDS Journal , Winter, 1982, gives us some wise council on the characteristics of computers we should work to exploit. He says to choose instructional events for computers which:

(1) Telescope time and images (compress them into a short period of time)
(2) Provide an active reponse by the student.
(3) Use the power of the computer to generate problems or data.
(4) Provide multiple presentations levels for individual students.
(5) Provide information storage and retrieval.
(6) Provide real time experiences.

For the learner, he suggests we choose programs which will:

(1) Provide active response and feedback.
(2) Provide learner control.
(3) Be self-pacing.
(4) Be scheduled at the convenience of the student.
(5) Be repeated at any time the student needs it.

In contrast to the Leiblum article, I should like to describe what I think we should not do with computers in schools.

Becker, from Johns Hopkins University, describes for us his study where a single microcomputer was put in each of six classrooms. Teachers were given a short in-service program and were encouraged to use the computer any way they wished. No courseware for the computer was provided, so most teachers tried to teach a little programming. The computer was available to the students for three weeks and the research staff made on-site observations and followup interviews. Each student had an average of 10 minutes of computer time over

the three week period. While teachers were generally grateful that they had had the experience, Becker was disillusioned about what a single micro could do in a classroom.

My question is, If you give a child ten minutes to work at a computer, what can you expect to happen? Nothing . Why do we criticize a technology and its promises if we utilize it so thoughtlessly? It is ludicrous, in my opinion, to attempt a computer literacy curriculum with a single microcomputer per school. A single micro can make a difference, but only when careful planning and wise utilization will allow it to do so.

If computers are to succed, it seems to me that school library media specialists should be the leaders of that technology in their schools. Who else in the school has more experience with technology than we do? But, are we the leaders? Are you preparing yourselves? Is someone else taking the lead in your school?

I have a few recommendations for school library media specialists who wish to take a leadership role:

Purchase software that:

- .does what a teacher cannot
- .utilizes computer characteristics
- .is in skeleton form (template - you can add your own spelling words/quesions, etc.)
- .assists teachers in day-to-day management
  - test generation/scoring
  - roll books
  - data retrieval
- .does more than just drill and practice
- .is computer assisted teaching (this is where the teacher can show a program to a class or small group and the computer provides computational power to show or demonstrate some concept

Encourage:

- . proper utilization
- . adequate facilities
- . proper equipment
- . ample software
- . careful planning
- . proper care, storage and retrieval systems for software
- . use by every area of the curriculum (not just the math department)
- . production of software in the school
- . fruitful in-service training

MY BEST HOPES FOR COMPUTERS AS TEACHING TOOLS

I feel that both in terms of learning, computers have a bright future in education. Some of the applications that I have great hopes for include:

(1) The potential of word processing and children. The power for them to write more and to correct their mistakes easily may just give us the boost we so desperately need in the language arts.

(2) The potential of computer assisted teaching. A teacher who uses the computer to show the class examples, draw graphs, solve equations, explore sounds, manipulate situations and events is using a very powerful technology as a teaching tool.
(3) High level languages are being created for computers which can free the children to explore ideas and concepts in ways they have never been able to do before. I refer to Logo, Smalltalk, and Solo.
(4) Computer applications in disciplines such as music, art, advanced scientific concepts, and the social sciences are quite exciting.
(5) Skills such as decisionmaking, linear thinking, problem solving, logical thinking, information retrieval and manipulation of data are likely to be affected by the power of the computer in schools.

MICROCOMPUTERS AND SCHOOL LIBRARY MEDIA SPECIALISTS

I should like to digress somewhat from the subject of my talk in closing to include a few comments on the potential of computers as management tools in the library media center.

Suppose you find that the microcomputer in your school is gathering dust. I suggest that you steal it for use in managing the library media center.

During the past year, I assisted Dr. Blanche Woolls at the University of Pittsburgh with a survey of administrative uses of high technology. We found some fascinating uses of technology in general and computers in particular. From that survey and from my own perspective, I see:

(1) A tremendous potential to manage our warehousing function (circulation, overdues, inventory, etc.).

(2) A great potential to share resources across school and district boundaries because most of the clerical part of this task will be manageable for the first time.

(3) The power to segment the entire collection in the computer's memory into hundreds or thousands of mini-collections which serve curricular objectives. The collection would be physically stored as we store it today, but we could generate annotated bibliographies on any curricular unit taught in the school. This bibliography would not only include access to the local collection but to resources elsewhere.

(4) We could manage our selection procedures so that the items we bought would more nearly meet our collection development goals. The computer could help us map our collections so that we could ascertain strengths and weaknesses.

(5) We could use the computer to recommend deadwood to

weed. We could also do inventory at any time on a segment of the collection.

(6) Information retrieval for children and young people is certain to grow, even though most of the data bases available now are irrelevant for their needs.

In closing, I feel that both in terms of learning and in managing our library media centers, computers have a bright future. It is our challenge to be astute enough to make something valuable and worthwile happen.

(What follows now is the handout which was given out at the meeting. It includes all the references made in the talk with annotations taken from the documents themselves.)