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ABSTRACT

Prepared as part of a series applying recent research in oral and written communication instruction to classroom practice, this booklet examines the role of technology in the classroom. Following a brief discussion of the impact of television on students, the first major section of the booklet explores the power of television as a curriculum tool. The second section reviews the new technologies, such as videodiscs, microcomputers, and word processors; discusses new applications of computers in the language arts; and refutes two myths concerning computers--that they are dehumanizing and that students' interest in computer instruction is due to the novelty of the experience. Other topics discussed in this section include the microcomputer-based curriculum being developed by Bolt, Baranek, and Newman through Department of Education funding; the Writer's Assistant program produced by researchers at the University of California at San Diego; and the microcomputer software developed at the Wisconsin Center for Education Research for use in teaching young children speaking and listening skills. The final section presents some drawbacks of computer instruction. (FL)

Using the New Technologies in Language Communication Education

By Nancy S. Olson

The Talking and Writing Series, K-12: Successful Classroom Practices

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The purpose of this series is to provide information to assist teachers and curriculum planners at all grade levels in improving communication skills across the major disciplines.

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PREFACE

During the past decade, teachers, education administrators and researchers, and the general public have become increasingly concerned about students' ability to communicate. This broad public concern for improvement in education led to the enactment of Title II, Basic Skills Improvement Act, Public Law 95-561. The Basic Skills legislation encourages Federal, State, and local education agencies to utilize " . . . all available resources for elementary and secondary education to improve instruction so that all children are able to master the basic skills of reading, mathematics, and effective communication, both written and oral." Section 209 of the act specifically authorizes the Secretary of Education to collect and analyze information about the results of activities carried out under Title II. Thus, improved instruction in the basic communication skills—speaking, listening, and writing—has become the focus of programs and research projects throughout the country.

The booklets in this series, *The Talking and Writing Series, K-12: Successful Classroom Practices*, provide information to assist teachers and curriculum planners at all grade levels to improve communication skills across all major disciplines. Developed under a contract with the U.S. Department of Education, the 12 booklets apply recent research in oral and written communication instruction to classroom practice. They contain descriptions of teaching practices; summaries and analyses of pertinent theories and research findings; practical suggestions for teachers; and lists of references and resources. Also included is a booklet on inservice training which suggests how the series can be used in professional development programs.

The booklets were developed through the efforts of an Editorial Advisory Committee comprised of 14 professionals in both the academic and research areas of written and oral communication education. The group worked with the sponsoring agency, the Department of Education's Basic Skills Improvement Program, and Dingle Associates, Inc., a professional services firm.

The committee members, in consultation with the Department of Education staff, chose issues and developed topics. Ten of the 14 committee members authored papers. The committee reviewed the papers and provided additional expertise in preparing the final booklets, which were edited and designed by Dingle Associates.

We are grateful to the committee members, advisors, and all others who contributed their expertise to the project. The committee members were:

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It is hoped that the booklets in this series will be valuable to classroom and administrative professionals in developing or restructuring their communication skills programs. They may also be useful to community and parent groups in their dialogue with members of the educational system. The ultimate benefit of this project, however, will be realized in our children's enhanced ability to communicate, both orally and in written language.

Sherwood R. Simons
Project Officer

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USING THE NEW TECHNOLOGIES IN LANGUAGE COMMUNICATION EDUCATION

By

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INTRODUCTION

It is Saturday morning, and Pac-Man is the hottest video game in shopping mall arcades. At home, kids tune in to "Heathcliff and Marmaduke" or "Discovery."

The average American child voluntarily spends 28 hours weekly involved with electronic media, estimates Mary Alice White, of Teachers College at Columbia University, and another 25 hours, mostly assigned, with print materials. We have entered what she calls the "Electronic Learning Age," and educators must realize that outside the classroom, new technologies are changing how children give and receive information.

White, who directs the Electronic Learning Laboratory at Columbia University, says that children, by age 3 or 4, "have learned that music and sound effects, and sometimes changes in types of voices, are cues to make them look at a TV screen. They are familiar with words as a spoken source of information, but words are secondary to the visual image on the screen."

In most classrooms, however, because the spoken word is the primary means of instruction, children need to be taught anew when and how to pay attention, according to White. Since the 1950's, teachers have said children do not listen the way they used to, and "I'm sure it is true that they do not," she says.

Television has taught that "learning is entertaining, that it is immediate, and that it is fun," she explains, while school work is often hard. In addition, teachers tend to be "print people" by virtue of their own print education; they draw on a pedagogy developed largely through study of how children learn from and with words. Image learning raises new questions for educators, says White.

She is convinced that teachers must stop fighting new technologies and start learning how they work. They must recognize that they are competing with music, sound effects, and technical effects—"everything technology has come up with to keep your children's eyes glued to that TV screen." Teachers should not expect students to pay attention all the time, she continues. They should develop cues that tell students what is important to listen to. And teachers should study electronic learning to see what they can use as a bridge to print learning.

The work of Dan Anderson at the University of Massachusetts and that of White at Teachers College suggest that children, when they watch television, pay attention primarily with their eyes to grasp information, and use the sound coming from a television set to orient themselves. Young children playing with toys in one of Anderson's experiments turn to the television when certain auditory cues come on, such as an upsurge in music, children's voices, or certain technical effects. "But these act as cues to look, and their information is gotten primarily from looking," says White.

When children enter the first grade, they have spent a minimum of four years "learning with their eyes, and they're primarily, we think, visual learners," says White. In school they are expected to be auditory learners. "We're facing an entirely new ball game here," she says. "How do you get

images out of the heads of children by asking them with words? 'Tell me, pupils, what image do you have in your head of so and so who was on the news last week?' What I'm wrestling with is how to be able to come up with some kind of imaginative technique of using images to retrieve images. I haven't solved it yet, but that's the frontier we're at. It's a whole new world in research."

THE POWER OF TELEVISION AS A CURRICULUM TOOL

For more than a decade, television has been used as an instructional aid in the classroom, yet the skills to use, analyze, and learn from television are still underdeveloped in the educational community. While instructional television is available in 74 percent of all classrooms, according to the Corporation for Public Broadcasting, the National Center for Education Statistics reports that only 17 percent of teachers are trained to use it.

Many instructional television programs that focus on language are available or being developed. One example is the Agency for Instructional Television's ThinkAbout series of sixty 15-minute lessons that help strengthen reasoning skills of fifth- and sixth-graders and review and reinforce their mathematics, communication, and study skills. The ThinkAbout series uses an integrated approach to curriculum that blends skills presented in clusters. Twelve of the 60 programs highlight basic communication skills; each program deals with both receptive and expressive language skills.

In ThinkAbout's "Collecting Information" cluster, entitled "Where Do I Go?", two boys who sight a UFO while camping try to identify what they saw by interviewing people, library research, and reasoning skills. Throughout the program, the characters are shown using communication skills, always for a real purpose. Students can see how these skills can be applied in their own lives.

"The Write Channel," a series developed by Mississippi Educational Television, provides third- and fourth-graders with opportunities to practice sentence-combining. In this series of fifteen 15-minute programs, an animated character, R. B. Bugg, interacts with live characters. Bugg covers news stories for WORD-TV. When he returns to the TV station with stories, an editor assists him in combining simple sentences by using coordinating and subordinating conjunctions, and in making his sentences more interesting with adjectives, noun clusters, and phrases. The series shows Bugg rewriting and invites children to help Bugg think up endings for some of his unfinished stories.

"Zebra Wings," also from Mississippi ETV, stimulates the imaginations of fifth- and sixth-graders and promotes their creative writing skills. The series host interacts with a panel of three children in discussing poetry, short stories, fables, myths, and newspaper articles. Many of the programs take viewers "on location" to stimulate creativity, and some programs solicit responses from viewers.

Don Kaplan, author of *Video in the Classroom: A Guide to Creative Televi-*

sion, encourages educators to produce student-created television in schools. For example, he thinks that with a minimum of media hardware, students can play games consisting of taping improvisational activities that encourage student self-awareness, spontaneity, and creativity while helping them to become familiar with the equipment and its techniques. He sees video as a valuable tool for improving visual and verbal skills that enhance interpersonal communication in the classroom.

"The true power of video as a curriculum tool is that it goes beyond a single subject area, and allows the teachers to integrate various components of their existing curricula into one all-embracing educational experience," says Joanne Fredrickson, project coordinator of an ESEA (Elementary and Secondary Education Act) Title IV-C project, "Developing Core Curriculum Through Video."

In Fredrickson's video project, students and teachers in 12 elementary schools in Albuquerque, N. Mex., use the skills of critical thinking, organization, sequencing, perception, visual and auditory discrimination, communication, research, analysis, creativity, and cooperation as they write and produce video programs.

Interactive video

Video has long been popular among speech teachers as a means for student self-critique of language use and delivery. But now some video users are branching out of the closed classroom into interactive video. Over the past 7 years, the Unified School District of Irvine, Calif., has become through cable television a tuned-in community.

Irvine educators have established a Unified Information System in which two-way interactive cable television links 17 of the district's 21 schools, the public library, city, the University of California at Irvine, and every home with a television set.

Students in four or five schools join in a discussion of "Music from Beethoven to Kiss"—with more students from other schools invited to participate. Other programs, most of which are devoted to acquiring the basic skills, make it possible for students across the city to share lessons, research, learning games, school news, discussions with experts, and videotapes received from students in foreign countries.

Irvine Superintendent of Schools A. Stanley Corey believes that productive learning occurs when communication technology serves four purposes: 1) provides economical one-to-one interaction among teachers and learners; 2) offers access to information resources beyond the school site; 3) enables personal control of and responsibility for learning; and 4) allows "fluid time," unconstrained by traditional concepts of class scheduling.

QUBE, a two-way cable system in Columbus, Ohio, allows an instructor and students to communicate in a limited manner during the broadcast of a college course. Each subscriber has a push-button control that allows selection of 30 channels and one of five response choices. When students respond to questions asked by the instructor, answers are transmitted back to the computer at the cable company's station. In this way, the instructor knows

who is participating in that particular session. The instructor can receive answers both collectively and individually when members of the audience activate response buttons.

Some educators predict a three-level electronic information-entertainment system. The first level is commercial television, the second level is cable TV, and the third level is videodisc. Some predict that the "good stuff" now on commercial television will be taken off, put on cable, and sold. And the very top programming will go on videodisc because it is more profitable to sell discs.

THE "NEW TECHNOLOGIES"

Although today's students are quite familiar with television, there are other "new technologies" that are making their way into the classroom, such as videodisc, cable TV, microcomputers, and other electronic learning aids. The much publicized "electronic learning revolution," however, has been slow to occur, due partly, some think, to teachers' fears of the new machinery and of their being replaced.

Videodisc

Some hail the videodisc as being the most important new teaching tool on the horizon. The videodisc is special in educational settings because it allows students to pace their own instruction by manipulating a few simple controls. For instance, in addition to watching and listening to a segment straight through, learners can view a video sequence frame by frame, in slow motion or speeded up, or "freeze" a particular picture for careful analysis. Hooked up to a microcomputer, the videodisc can become a computer-controlled interactive learning center. Students will be able to answer questions posed by the microcomputer while viewing presentations that reinforce and test learning.

The California School of the Deaf in Riverside is testing a system to teach language development using a disc player interfaced with a microcomputer. Children use a "light pen" to write responses directly on the video screen. A 28-minute disc produced by the school combines 525 slides and videotapes. All special effects, like freeze-frame, can be activated by touching the screen with the "light pen."

In 1983, Schooldisc, a videodisc package developed by the National Education Association, ABC Wide World of Learning, and Pioneer will be available to cover the basic skills for fourth- through sixth-graders. Programming includes language arts, science, and current events based mainly on material from ABC news shows and documentaries.

The U.S. Department of Education estimates that only about 150-200 elementary and secondary schools in the United States currently have videodisc players. Lack of software that maximizes the disc's potential for participative and interactive use may account for the lack of educational use. However, software developers predict that in about 2 years, videodisc titles will be available embracing the entire range of curricula.

Surveying the scene

Marc S. Tucker is currently assessing the potential of the new technologies in elementary and secondary education through a project funded by the Carnegie Corporation. He and his fellow researchers are highly optimistic about the new technologies—microcomputers in particular.

Tucker suggests that a future scenario for classrooms will be a student sitting in front of a console that contains a personal computer, a videodisc player controlled by the computer, a television screen, and a device to connect the console to a variety of telecommunications systems.

What Tucker sees as the problem, however, is inadequate software. He says that thus far the new technologies have been used to "push facts into students—what Mao Tse Tung called 'stuffing the duck' " (Heard, 1982, p. 12). Tucker warns against relying on computer vendors and educational publishers to develop good software in response to market demands.

Computer innovations are already being adopted rather rapidly in affluent school districts, with implications for increasing inequalities between rich and poor districts. "Although it's not clear yet that using the new technologies will confer an enormous advantage in learning, it is clear that they definitely will do so with respect to learning how to use a computer," says Tucker.

The Office of Technology Assessment, a Congressional research agency, is concluding a 2-year project, part of which examined the impact of the new technologies on elementary and secondary education. In preparing part of the study, Linda Roberts, of the Department of Education's Office of Libraries and Learning Technologies, visited schools across the country to determine where there is significant application of computer technology.

It is difficult now to generalize, she says; the field is changing day by day. According to Roberts, much of the instruction is drill and practice, but a few districts are going beyond that to use the computer for more advanced learning tasks.

There is a push to get away from using computers solely for mathematics, says Roberts, and to make their use interdisciplinary. "One sense I have about the future of all the technologies," she says, "is that they are means, tools, not ends. We must look now at the content—what we are trying to do with the tools."

Computers in writing

In the next 5 years, the biggest impact in the computer area will be in writing, predicts Robert Taylor, of Teachers College, Columbia University. "Computers," he says, "will make clear that writing is a process. Students will not mistakenly think then that some people can write and some people can't. They will see that it is a refinable process." Microcomputers, programmed as word processors, make writing easy and fun, says Taylor, and lead young writers to write more, which leads to better writing.

For example, with word processors, students have the freedom to instantly shift around letters, words, and paragraphs on the computer screen or to "erase" them and bring them back later. "The computer can also

automatically correct such things as spelling and punctuation. This will lead to debates about learning to spell, similar to the debates about calculator use in mathematics," says Taylor. But such debates over spelling would be trivial, he thinks. What is important is that the computer teaches students to rewrite with ease. "*Nobody* likes to rewrite," he says.

In addition, computers make it possible for students to transmit drafts and documents to other students or the teacher to call up on their own terminals and read and comment on.

The two most important applications of the computer in writing, says Taylor, are the ease of rewriting and the possibilities for instant reorganization. This ease gives students a healthier view, he says, makes them less anxious, and gets them out of the "gee,-I-can't-write" syndrome.

Says Taylor, "If we can do anything to improve the way students feel about writing and the ease of writing itself, by all means we should do it. If this means taking away the mechanical drudgery, then do it."

Taylor relates one student's comment after the student had used a text editor during a summer special program: "I wish we had a computer in our school to do this. It makes writing look better than it really is." Taylor foresees changes in the keyboard as the next step in facilitating writing via computer.

Although computers traditionally have been used for drill and practice on basic concepts and skills in subjects like math and science, some fear that they will never go beyond this. Richard Anderson, of The University of Cincinnati, who has written computer programs for English grammar and composition, feels that after his 12 years of experience with computers that the computer is best suited for "concrete, skill-mastery composition, skills such as grammar and spelling, skills with clear-cut right and wrong answers."

He says, "The computer can tell a writer that a comma is in the wrong place, ask what kind of paragraph the student has just read, ask which is the topic sentence." But he adds that computers will never be able to identify "style" in writing or "creativity."

But the advantages, according to Anderson, are that the students, who are alone and unembarrassed, can work with a computer terminal. Self-image is enhanced because students "control the fanciest tool to come down the pike." They move at their own pace, and "nobody gets mad at them."

With computer use, says Anderson, teachers are freed for human creativity during classroom instruction; the computer handles the remedial, skill-mastery, and right-and-wrong-answer-type instruction. The teacher can concentrate on "style."

Researchers cite several reasons why students have a positive attitude about being instructed by computer.

1. Because students set their own pace, they absorb and comprehend material without inconveniencing anyone else.

2. They can make mistakes without embarrassment; only the computer knows.

3. They get immediate feedback that their answers are either correct or incorrect.

4. The computer bases its evaluations solely on performance, not on such things as the student's relationship to the teacher (Clement, 1981, p. 28).

Two popular myths perpetuated by opponents of the use of computers in the learning process seem to have been disproved in the literature (Clement, 1981, p.29). The first is that computer-based instruction is dehumanizing. In reality, Clement reports that the opposite seems to be true if student self-reports can be believed. "Most students find the computer exciting to work with," calling it "friendly," patient, and undismayed by their mistakes, according to Clement.

The second myth is that high student acceptance of computer-based instruction is due to the novelty of the experience. Longtime computer users do become more critical of computer breakdowns, but their feelings remain positive, says Clement. Students tend to spend more than the prescribed time at the terminals.

Beverly Hunter, of Human Resources Research Organization in Alexandria, Va., suggests that it is essential for students to spend plenty of time on the terminal to use it with ease. "It's rare in elementary schools today that kids have that much machine time. You can't learn to master writing on a terminal in a few weeks," she says. "A good system for kids would have a built-in typing tutor," she adds.

Hunter's own 12- and 14-year-old sons now compose writing assignments on a home word processor. They are not good at making an outline or organizing, she says, but with word processing, they find it easier to begin to rearrange and reorganize, to edit and correct grammar and spelling, to put in headings. "With hand writing," she says, "this is a difficult process. They're bored after two or three drafts. They have writer's cramp. With word processing, the mechanics of reorganization are trivial, and when they're through, they have a pretty product."

For those kids whose work is sloppy, this may be the first time that they have "a pretty product." "Word processing opens up the possibilities of striving for perfection," she emphasizes.

Nancy Taylor, from Catholic University, agrees that in traditional writing instruction, many students fail to proofread and edit their products. "Text editing on the computer overcomes the mechanical aspects which often deter children's revision and development of written work, such as problems in reading their handwriting, difficulties in inserting corrections, or elaborations. In addition, the computer can be programmed to remind the child to proof certain things before signing off" (Wall and Taylor, 1982).

A unique feature of computer-based writing instruction is that teachers can compare the student's original and revised versions, evaluate progress, and record and monitor student achievement of learning objectives in individual progress files. Through the computer storage system, the teacher, principal, child, and parents have evidence of the student's progress in writing.

Taylor adds that through the computer's imaginative visual display capabilities, children may enjoy their skill lessons and be interested in further computer work.

Kathleen Gilbert, who teaches math, English, and computer programming in Colorado, suggests that combinations of computer graphics, color, sound, and changing displays will assist student writing—in composing new forms of poetry, for example. In a computer program being developed by Gilbert, students will describe parts of speech and grammatical rules to the computer, and the computer will then display a variety of sentences based on those rules.

Gilbert thinks that the computer is a powerful tool for fostering new forms of learning. For example, students can interact with the computer to compose a story. Imagine the computer requesting a time, place, and setting for a story, she suggests, and the student responding at the terminal. The story unfolds then as a collaboration between student and computer (Gilbert, 1981, p. 13).

The Department of Education has funded Bolt, Baranek, and Newman, a research group located in Cambridge, Mass., to develop a microcomputer-based curriculum to help teach writing to upper elementary school students. "At the highest level," says Andee Rubin, supervisor of Software Development, "we want to provide the tools and environment that will help students write."

The program being developed has several components. Using text editors, students will compose written works and exchange information with each other. For instance, says Rubin, a student can type, "What happened on 'Hill Street Blues' last night?", and other students in the class can respond. The student who asked the original question can bring up on the screen the responses that have been made or print them out in hard copy form

In addition to exchanging information with each other, students will make their writing public, the way adults do. They will put together a class newspaper on the computer that can be read either on screen or on a printed copy. "Students will be able to make the text look physically attractive," says Rubin, "with publication aids that provide formatting, such as centered titles and different typefaces."

Printers are fairly expensive, she says, but the program's developers think that they are essential. "In terms of writing," she says, "we think it's crucial to have paper. You can't buy a minimal system and use this program."

In addition, a "message system" on the computer will enable students to send messages to each other within the class or possibly across country.

"We're finding kids write more on the text editor," she says. Why? "My guess would be that they don't have to worry about spelling and such matters. They can go back easily to make changes. They're freer to get down what they want to say." The program will be field-tested in 1983 in three schools.

Colette Diute, a psycholinguist at Teachers College, Columbia University, thinks that the speed of output of microcomputer text editors affects the writing process. Her research with students at the United Nations School in New York is focusing on how the computer frees the writer of the cognitive burdens of writing.

She is working with three groups of students: one that uses a word processor, one that writes with paper and pencil, and a third that writes with

a word processor that prompts them to check such things as spelling, usage, and sentence structure errors. The reason for prompting in the last group is not to focus on errors, but to see what it takes to encourage students to revise.

Says Diute, the kids "love writing on the computer." They report that writing is a lot easier, and she feels that they also revise more. When they do not need to recopy, she says, they are freed to compose. Students are no longer forced to compose and evaluate and edit at the same time.

The Writer's Assistant, a computer program developed by researchers at the University of California-San Diego, is now used by fourth-graders in Oceanside, Calif. The program is composed of a screen editor, software that allows students to rearrange a text, and spelling verification.

With the capability to rearrange text, students can separate each sentence from a paragraph to see more easily, for example, if it is a run-on or a fragment. Students verify spelling by moving the cursor over a word on the screen that they are uncertain about; the computer phonetically matches that word against words in the computer file. If a child has written "sale," the computer might come up with "sail" and give a brief definition. Seeing that that is not the correct word, the student types in "no," and the computer searches further.

With this approach, the writer must first make a guess at the correct spelling, then the individual receives spelling verification. This program differs from traditional computer spelling verification in that traditionally the computer checks every word against a built-in dictionary after the writing is complete.

Spelling verification came about because a teacher in Oceanside had her students write out the word or words that they did not know; she would check each student's word list. Now the computer handles this task.

The Writer's Assistant spelling verification is easy to personalize with words students need, says Jim Levin, assistant research psychologist at the University of California who is working with the Oceanside students. He says that spelling verification is also the most popular command, based on the number of times students use it.

The Writer's Assistant is a powerful tool for researching the writing process, says Levin. Since it keeps a detailed "trace" of the keystrokes made by the writer in generating and changing copy, researchers are using this trace data to study the processes involved in writing.

For example, two boys, Gerry and James, used the Writer's Assistant to create a story called "Dragon Tamer." Researchers were able to analyze the boys' low-level processes like spelling or typing correction. At one point, Gerry and James changed "sonr" to "sorddr" to "sorcery."

The Writer's Assistant also keeps track of higher-level, more global actions, such as large-scale deletions of previously entered text, as well as insertions of new text. For example, the original title of the story was "Dragon Slayer." At the end of the writing process, Gerry and James changed the title to "Dragon Tamer" because they had modified the theme of the story from winning the king's daughter's hand in marriage by slaying the dragon to slaying or taming the dragon.

Levin thinks that the Writer's Assistant is important because it allows the teacher to observe different problems novice writers experience and then provide the needed individual support. "For novices, much of the effort of writing is distributed externally, both over other people in the setting and over inanimate resources like print and computers. As the novice writer becomes an expert, this external support becomes less necessary, as more of the cognitive processing can be done by the writer. Our goal in designing microcomputer-based environments for writing has been to create settings in which the support provided by the environment can be reduced dynamically as the writer progresses to expertise" (Levin, Boruta, and Vasconcellos, in press).

Levin says that it is "crucially important" that children use the computer in pairs. Demands on teachers are then substantially reduced because most problems that arise for one student can be handled by the other. Students also cooperate to improve their work. "In contrast to the stereotype that computer use leads to isolation of students from their peers, this paired student use generates substantially increased interaction between peers, compared with other classroom activities (Levin, Boruta, and Vasconcellos, in press).

These interactions most often mutually benefit both students. When one child encounters a block in writing, the other child who has a different viewpoint can offer alternative approaches. And, for research purposes, having pairs of children use the computer generates "ecologically valid 'protocols' of the children's writing processes, as each child explains to the other what actions to take and reasons for those actions when there is a conflict."

Students who were tested before and after 4 months of Writer's Assistant use showed positive results when compared to students who wrote with paper and pencil. The students who had access to the program increased the average number of words per writing sample from 45.1 to 74.1 words. The control class showed virtually no increase in average length of writing sample (prescore—44.6; postscore—46.4).

The writing quality rating was based on a four-point scale, with the judge blind to the classroom from which the samples were collected. The judgments were "holistic," with adherence to topic and organization emphasized while mechanics of spelling, punctuation, and so on were de-emphasized. The qualitative score for the experimental class increased from 2.00 to 3.09 after 4 months of using the Writer's Assistant. The control classes had a prescore of 2.27 and a postscore of 2.24.

When asked, "How is writing with the computer different from writing with paper and pencil?", most students responded positively with comments like, "It's funner and easier than writing with paper and pencil. Also it does not hurt your hand."

Levin said that there were two negative comments. One student complained about accidentally hitting the wrong key and making his writing disappear; another felt limited by not being able to do drawings as part of his writing.

In the spring of 1982, the Oceanside students began communicating with students in a small town 150 miles northwest of Anchorage, Alaska, via com-

puter hookup. Students in the two States are expected to share class newspaper articles and then to send individual messages. It is anticipated that teachers will also communicate with each other, which could be particularly helpful to teachers in rural Alaska who may need the advice of a colleague.

This exchange of messages brings even greater social resources to the educational setting, broadening the range of peers available for children to draw upon for learning and problemsolving. Microcomputer electronic message systems have tremendous implications, says Levin, especially for education in remote or isolated areas.

Microcomputers in oral language

W. Patrick Dickson, of the Wisconsin Center for Education Research, has developed microcomputer software to teach young children speaking and listening skills. His work involves the kind of communication that is specific and measurable, such as directions on a map.

Dickson developed two communication games in which players must help each other rather than outdo each other. In one game, each of two players sits in front of a video screen which has an array of cartoon faces, abstract drawings, or other pictures. The player who is "speaker" tries to give enough information about one of the pictures so that the "listener" can distinguish which picture the "speaker" is describing. Players get up to three chances for each array, and tones tell if the listener's choice is right or wrong.

In Dickson's second game, children practice oral language to describe locations and relationships: Players give each other directions to a location on a map of a model city shown on the computer screen.

Dickson says that the games elicit rich, noncompetitive interaction from students, and such cooperative activities promote communication as well as social interaction.

Research on interracial friendship and cooperation in schools fostered by team learning leads Dickson to speculate that these computer games can be used to deliberately bring together kids who otherwise might not interact—black with white, English speakers with non-English speakers, boy with girl.

Although games can certainly be played without using computers, microcomputers make it possible to adjust the difficulty of the games to the abilities of the players. "That means," says Dickson, "we can individualize without any intervention of the teacher. The computer monitors the activity, and if the kids are making a lot of mistakes, it will simplify the display. If they're making no mistakes, it can make the tasks more complex" (*Wisconsin Center for Education Research News*, Fall 1981/Winter 1982, p.2).

Another advantage is that computers are stimulating. The machines can get and hold attention with color, sounds, motion, and light, and children can interact with them. And, they offer teachers recordkeeping capabilities for each student. The teacher can then get a better sense of a child's speaking and listening abilities or suggest pairing kids that have complementary needs and abilities.

Dickson hopes that he will eventually be able to help teachers to accurately assess children's oral communication abilities with this kind of computer game.

Another project from the Wisconsin Center is focusing on designing interactive microcomputer programming to teach action verbs to children with physical and developmental disorders. Believing that action verbs are critical to children's spoken language development, communication disorder specialists want to develop ways to assess the children's comprehension of verbs and their ability to use them.

Actions represented by up to 25 verbs, such as "walk," 'sit," and "run," will be demonstrated by moving cartoon figures to be shown in split-screen pairs and be accompanied by verbal instructions, test sentences, or questions presented by microcomputer. Children with minimal motor control can use special sensitive micro-switches, light pens, or "joy sticks" to reach beyond their physical restrictions and learn language through interaction with the computer.

Because not much study has been done in this area—particularly in verb comprehension—researchers anticipate doing fundamental research in early semantic development during the 3-year project.

DRAWBACKS OF COMPUTER INSTRUCTION

Although classroom use of microcomputers is increasing, and many teachers are enthusiastic, only a comparatively few microcomputers are used in English courses, primarily in elementary and middle schools. Market Data Retrieval, Inc., surveyed the country's 15,500 school districts and found that 17 percent—or 15,000—of the nation's schools have at least one microcomputer. TALMIS, Inc., a microcomputer industry market research firm estimates that there are 90,000 microcomputers in schools today—the vast majority of which are used for math and science and computer-use classes. TALMIS predicts that by 1985, there will be as many as 400,000 microcomputers available to U.S. students.

The complaint heard most often from all parts of the country regarding use of computers for instruction concerns the poor-quality software currently available. As more and more educators begin to use the computer in the classroom, they will become more discriminating purchasers, and even programmers.

For the three best-selling machines (the Radio Shack TRS-80, the Commodore PET, and the Apple II), some good software is available, according to Karen Billings, director of the Microcomputer Resource Center at Teachers College, Columbia University. But several problems exist: Much of it does not fit teachers' needs; software developed for one machine cannot be used on another manufacturer's model; and it is expensive. Schools commonly blow the budget on hardware at the expense of software.

Poor-quality software and the incompatibility of different manufacturers' software led the Minnesota Educational Computing Consortium (MECC) not only to set up a software dissemination network, but also to endorse a single manufacturer's microcomputer equipment for use in the State's schools. Now, Minnesota schools, and those in other States, can purchase software from MECC and receive it via telephone hookup in minutes. MECC

also runs workshops for teachers and spends an estimated $40 million annually to help schools make the best use of computers.

According to *Electronic Learning* (November/December 1981), good-quality software should:

- be free of "bugs" or "glitches" (technical problems or errors); should load properly and run smoothly; and should be error free. As one educator points out: "It's amazing how many programs have simple spelling errors in them."

- take advantage of the machine's unique capabilities without substituting flash for substance. It should be more than a workbook on the screen and should enhance learning of certain tasks better than a teacher or a text. Word-processing programs and Typing Tutor (from Microsoft) demonstrate the power of the computer while satisfying important instructional objectives as well, according to Jane Mestrovic, a math teacher at the Chapin School in New York City.

- provide positive reinforcement while helping students to understand wrong answers. Bob Jackson, regional coordinator of instructional computing for Fairfield and Westchester counties in Connecticut, says software should help kids understand concepts and rules. "So much of the spelling software that's out, for example, never gets to the rules of spelling. The word is either right or wrong. If you tell kids they're wrong without telling them why, not much learning will take place."

- include some diagnostic and branching features. Most educators agree that good-quality software should attempt to determine the student's level and adapt to individual needs. One program that educators frequently mention that exemplifies these objectives is Typing Tutor. The program keeps track of the time between the student's keystrokes and places those "slow to find" keys into the drill section.

- be creative and stimulate creativity among users. Students should not be locked into computer-imposed right and wrong answers. Some educators think that the game format is a creative use of the computer and believe that learning will take place faster while playing a computer game that requires learning to play successfully.

- allow for easy teacher modification. For example, in a program that provides drill and practice with vocabulary words, teachers should be able to add more difficult words for above-average students and easier words for slower learners.

- provide clearly written operating manuals, support materials, and activities.

A study of classroom use of microcomputers by New York City's Bank Street College of Education indicated that their potential for improving learning is limited for the present by several factors:

1. Student access to computers is sporadic and erratic.
2. Computers are rarely integrated into classroom work.
3. Good software is in short supply.
4. Claims about instructional value of microcomputers are largely unsubstantiated.

In addition, some educators fear that increasing computer use will have negative consequences, such as overemphasizing problems and ideas that lend themselves to quantification. Other educators are concerned that computers reinforce students' giving the quick, superficial answer.

Says Joseph Weizenbaum, professor of computer science at Massachusetts Institute of Technology (MIT), quoted in the *New York Times*: "Abraham Maslow once said that to him who has only a hammer, the whole world looks like a nail. To him who has only a computer, the whole world looks like a computable domain. You introduce a new symbolic system, and one begins to interpret the world in such terms. The danger is that we will end up thinking like a computer and that the only things we will recognize as legitimate problems are those where quantification and calculation play a big role."

Some educators see computers and other technology as further splitting American schools into the "haves" and the "have nots." "At the heart of the equity issue," says Linda Roberts of the U.S. Department of Education, "is who is going to benefit from the technology and who is not? We must ensure that all students become knowledgeable about a variety of electronic learning devices and their multiple uses."

One obstacle to creative use of computers, suggests Joyce Hakansson, a computer consultant and former coordinator of computer education at the Lawrence Hall of Science in Berkeley, Calif., is the fear of some educators that discovery learning may erode the traditional authority of the teacher. Some teachers do not want to compete with computers for the attention of students; others are used to being the information providers and now find that they know less about computers than their students.

Computers are not the first "technological breakthrough" that educators have witnessed over the years. Some are reluctant to jump on this electronic bandwagon, pointing to the unused language labs, teaching machines, the dusty 8mm projectors and video monitors.

But many are enthusiastic. Marvin Minsky, a founder of the Artificial Intelligence Laboratory at MIT, and his colleague Seymour Papert, creator of LOGO and other computer languages, see in computers the opportunity for changing our methods of education. Says Minsky:

The computer provides a more flexible experience than anything else a child is likely to encounter. With it, a child can become an architect or an artist . . . dealing with a computer, at least as Papert and I see it, allows a child to have a whole new set of attitudes towards making mistakes, which we call finding 'bugs.' We have not been able to find any other word for it. It does not seem to get taught in schools where the concern is to teach the 'truth.' . . . Seymour wanted to develop a working place for a child in which it would be a positive achievement when a child can find the things that can go wrong. If you know enough of them, you get close to something like the truth. This is what happens with children who use computers in the schoolroom environments that Seymour has set up, and, in this, the computers are essential since their behavior is so flexible. We hope that when a child does something that does not quite work out, he will say,'Oh, isn't it interesting that I came out with this peculiar result. What procedure in my head could have resulted in something like this?' The idea is that thinking is a process and if your thinking does something that you don't want it to do you should be able to say something microscopic and interesting about it and not something enveloping and evaluative about yourself as a person (Bernstein, 1982, pp. 123-124).

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