EDUCATION WEEK

Debate Grows on LOGO's Effect on Thinking Skills

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Dallas--In the late 1970's, the Lamplighter School here served as a laboratory for the development of the computer language logo for the microcomputers produced by Texas Instruments. The school has received national attention for its computer training for young students, which school officials say has helped many develop "critical-thinking skills" and greater interest in school work.

Students at the private, independent school spend at least one class period each day writing logo programs, using the computer's "turtles'' and "sprites" to draw pictures and create games on the screen of the computer.

The 3- to 10-year-old pupils, who receive less than an hour of instruction in using logo when they first enroll in the school, usually work with other students but independent of any obvious class rules. Occasionally during their logo sessions, the students take cues on how to improve a programming procedure from teachers, who quietly walk around the classroom, but they receive little formal instruction aimed directly at the program's chief goal.

Lamplighter officials and other leading experts in the educational uses of computers say logo, which can be easily understood by children because of its simple programming procedures, could be a central element in teaching children how to think logically in all subjects. They contend that programming in logo will give children computer-based models, or "microworlds," that they can use to approach abstract ideas in fields ranging from English composition to physics.

At Lamplighter, however, those contentions are not being directly tested. School officials say they will not conduct formal studies of logo's effect on students' academic performance and general problem-solving skills because they do not want to deprive a control group--which would be required for comparative purposes--of access to computers.

But those officials--and Seymour Papert, the professor of mathematics and education at the Massachusetts Institute of Technology who was the leading developer of the language--are paying attention to new research findings that question the assumptions underlying the typical use of logo today.

According to studies conducted at the Bank Street College of Education in New York City, students who learn to program with logo do not develop exceptional problem-solving skills that they can transfer to other settings. Those studies, according to Roy D. Pea, the research psychologist who conducted them, contradict most educators' statements about logo's efficacy.

"Everyone talks about [children] learning thinking skills just by programming in logo," he said. "That's the assumption in every single article."

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But that assumption was not borne out by the research, Mr. Pea said, and in consequence he recommends instead that teachers offer explicit instruction for applying the principles of programming that students learn through logo to other activities and depend less on "discovery" learning.

According to logo Computer Sys-tems Inc. in Montreal, the company that markets logo programs, between 200,000 and 250,000 children now use logo in schools and homes.

Coleta Lewis, who this fall assumed the direction of the Lamplighter computer program, said the school would attempt to link logo concepts more closely with major academic subjects such as English, foreign languages, mathematics, and science. Such logo applications are in the early stages of development, she said, and the Bank Street School report could influence the school's plans.

Mr. Papert, meanwhile, will meet with Bank Street College officials later this fall to discuss ways that the study's findings could be used to improve logo, Bank Street officials said.

For two years, researchers at Bank Street's Center for Children and Technology studied the performance on problem-solving tests of pupils in classes with 25 8- and 9-year-old children and 25 11- and 12-year-old children.

The most recent study, which took place during the 1981-82 and 1982-83 school years, compared the problem-solving abilities of children who had extensive logo programming experience with the similar abilities of children who had no such experience. The students from the two groups exhibited no differences when asked to devise an efficient plan for performing a set of classroom chores, such as cleaning the blackboard and moving furniture.

Students in both groups were asked to use a map of a classroom to devise a plan for performing the chores. Their responses, which were recorded on videotapes during the first year and in a computer database in the second year, were analyzed later.

In a report on the first year's experiment, Mr. Pea wrote: "On a large number of measures--the efficiency of the plans, the quality of the revisions, and the types of decisions made during the planning process--we found no differences between the programming and nonprogramming groups at either age." The results of the second year's project were the same, he said.

In another research project, students from the older and younger age groups programmed with logo for 25 hours and 29 hours, respectively. The students then took 45-minute tests of their ability to predict what certain programming actions would do, to write programs that varied in certain specific ways, and to isolate and correct problems in programs.

The average score on the first 100-point test was 34, with what Mr. Pea called a "huge" standard deviation of 25. Only three of the 50 students scored better than 75. Almost no students performed well on the second and third tests for the same research project, Mr. Pea said.

In a third study, six of the best programmers in each classroom were asked to describe what would happen when certain directions were written into a program. Few students showed an understanding of program instructions, Mr. Pea said, "even though they had written programs that contained them."

Early Stages of Research

Daniel H. Watt, author of the book Learning With logo and a contributing editor of Popular Computing

magazine, contends that any research on logo is bound to be incomplete because both the use of logo and research on problem-solving are in very early stages.

"Problem-solving is still an area that has to be approached very carefully. It's a very difficult area to research," Mr. Watt said. "logo is not magic. It takes a lot of planning and good educators to make it work. I don't think there's anyplace that has that yet."

The Bank Street research has led at least one educator to search for ways of using logo that would teach children explicit links between their logo programming experiences and critical-thinking skills.

A public elementary school in Norwalk, Calif., started a program this fall to develop the problem-solving capabilities of 140 students who are in compensatory-education classes under Chapter 1 of the Education Consolidation and Improvement Act. The program uses logo in conjunction with teacher-directed instruction and other classroom activities.

According to Stanley Pogrow, associate professor of educational administration at the University of Arizona and a consultant to the project, the premise of the program at Glizier Elementary School is that "programming in logo for logo's sake" does not teach problem-solving to any but the brightest pupils. Most students, he said, need to be shown how logo principles apply to other subjects.

Because any computer language can be difficult for young children to learn, Mr. Pogrow said, Glizier students may not actually work much with computers in the first year of the problem-solving program. Ultimately, he said, the students will take part in a variety of computer activities with logo and other soft-ware, as well as in more physical activities in which the student attempts to apply abstract concepts to concrete experiences.

"I think logo is a good idea, but you have to teach the generalizations," said Mr. Pogrow. Mr. Papert, he said, "seems to think that generalizations will occur spontaneously--and, indeed, probably for the brightest kids they do. ... We like Papert's ideas, but they have to be modified."

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