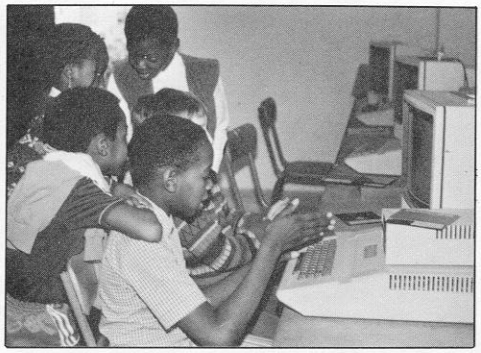
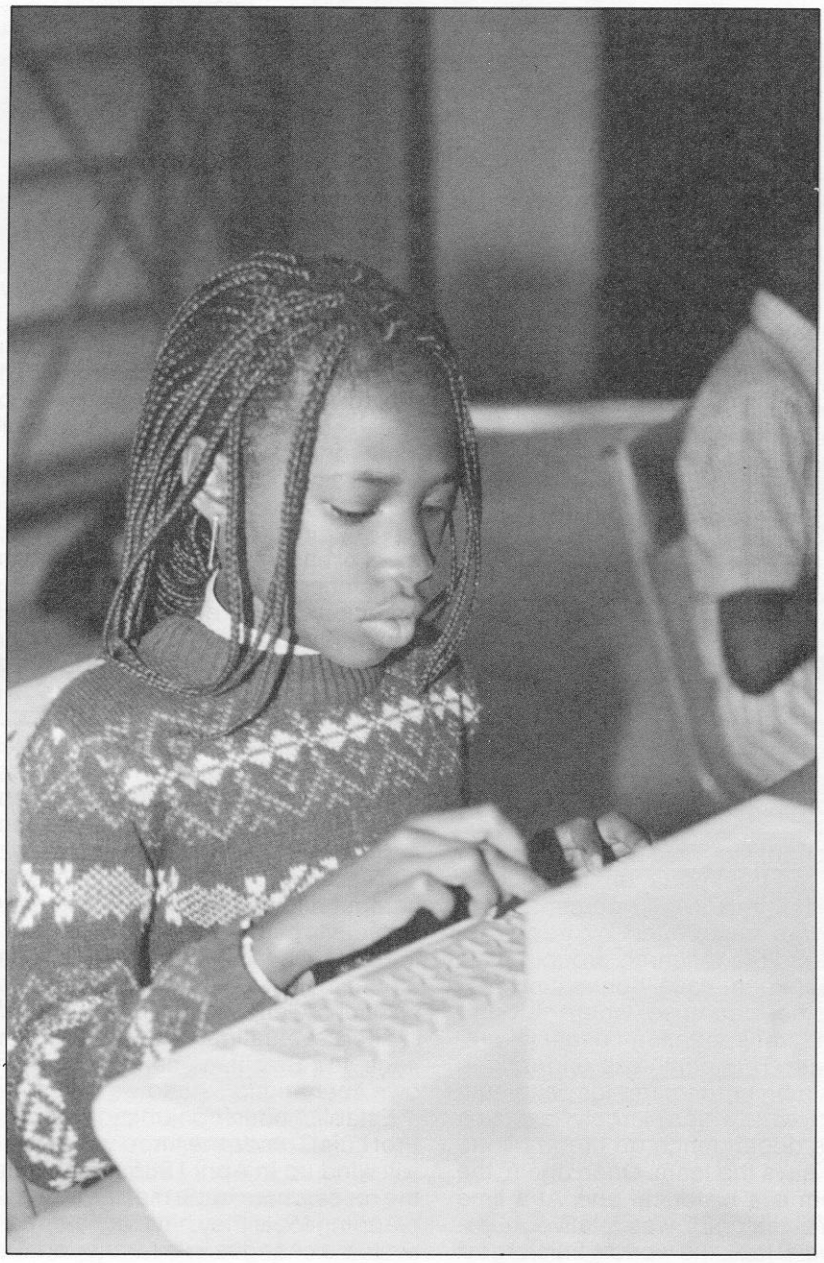


TRAINING THE ELECTRONIC TURTLE

ALIOU BARRY



Senegal does not want to be left behind in the computer revolution. The West African country was one of the first on the continent to introduce computer technology — in administration, for example — and now is seriously examining the potential applications of computers to education.

A major experiment in this area had its beginnings in January 1982 when a multidisciplinary team of Senegalese professionals went to New York to learn about a new technique in self-teaching via computer. The group, composed of a computer specialist, a mathematics professor, an educational psychologist, a sociologist and two teachers, was sent under an agreement involving Senegal's Secretary of State for Scientific and Technical Research (SERST), the Ministry of Higher Education, and the Ministry of National Education. IDRC supported the study visit. They worked with computer scientist Prof Seymour Papert, the creator and developer of an educational computer language called LOGO (see box).

After returning to Senegal, the team began its computer learning project in March of the same year at the École normale supérieure de Dakar, a training institute for teachers and teaching inspectors. The subjects of the experiment, pupils aged 7 to 11 from three schools in the Dakar area but from a variety of social backgrounds, attend three two-hour computer sessions per week.

After being taught the standard keys, the children are left to their own designs. With LOGO, the pupils program the computer themselves; in effect, they use trial and error to instruct the computer what to do, in the process teaching themselves a variety of concepts such as geometric relations. Every week members of the training team note any problems the children have in mastering the keyboard, the rate at which they learn mathematical procedures, and the programs they have created.

The pupils do not have much to say when one questions them. They are absorbed by their work and their reactions to it range from amusement to consuming passion. In the beginning, it was noticed that geometric problems engrossed the children's attention; now this kind of activity is rapidly becoming more complex as they associate elementary shapes such as triangles, and rectangles to make houses, trucks, masks and so on. In every case, success is achieved only after a significant number of errors have been made. Error rates decrease, however, as training proceeds.

After one year, the training team observed a greater mental alertness in the children with well-to-do backgrounds. However, the other pupils, even those from very poor families, eventually caught up and, according to one team member, are achieving the best results now. Regular teachers

have found that pupils participating in the experiment have improved in mathematics and, above all, are more curious in the classroom.

One curious thing about the experiment is an observed difference between the performance of girls and boys. The most satisfactory results have been observed among the girls. The experiment even brought to light the fact that one 8-year-old female participant was exceptionally gifted.

The short-term objectives of the experiment, according to SERST, are to record each child's achievements and the knowledge essential to them, and to analyze how this knowledge is used and formulated by children of the same age and of different ages. Another task will be to identify the pedagogical concepts at work in this learning process and to derive from them a body of knowledge that is indispensable for a particular age or level of achievement.

MISTRUST

As with any novel experiment, LOGO has met with and continues to meet with mistrust. Some people are worried about the future of Senegal's children who, as one teacher put it, "are fed everything that comes along without any thought being given to the priorities of the Senegalese school system or the conditions under which it operates." This teacher bases his concern on a number of teaching experiments in Senegal that were resounding failures. There is also the case of the unfortunate experiment in educational television in neighbouring Ivory Coast. The teachers say that more precise objectives must be determined for the project and, above all, that other ministries become involved through the creation of a steering committee.

Some teachers are also concerned about their professional fate and possible loss of authority. Says one teacher: "Computers have a one-way relationship with the student that is based on an erroneous idea of learning and education."

It is especially important that the costs of an eventual extension of the computer experiment to the rest of Senegal not exceed the costs of the country's present school system — which is already too expensive. According to some, cost will be the critical factor in the future, even if the price of computers continues to drop.

The objective of SERST is not to introduce this method hastily. Rather, it is conducting a research project with all its stages: evaluation, development, and general dissemination. SERST's task is to determine *how* to introduce computer systems into teaching, for the belief is that "whether we like it or not, they *will*, sooner or later, be introduced." The Senegalese authorities feel that the computer method must be studied now through experimentation as is being done in the developed countries, which are themselves only at this stage. They insist that Senegal, having missed the industrial revolution, must not miss the computer revolution.

With this in mind, the Senegalese are setting up an institute for research in applied mathematics and computer science. The project, now under way at the University of Dakar, began with the installation of a microcomputer systems laboratory equipped for software adaptation work. It was in this lab that the "primitives" (or elementary instructions) of the LOGO computer language were translated into Wolof, one of Senegal's six national languages. LOGO will also be translated into the other five.

The experts feel that the greatest handicap for the Senegalese experiment in computer-assisted education is the lack of specially adapted software. The experiment is being conducted with software designed by people from another culture. Even worse, according to a young Senegalese man who designed an office microcomputer, is that one almost has to design software for each student. Or, if not for every student, at least a large number of software programs would have to be designed. For the moment, the experiment in self-teaching continues — but with extreme caution. Whether Senegal is ready to expand such computer applications cannot be decided before the multidisciplinary team completes its work.

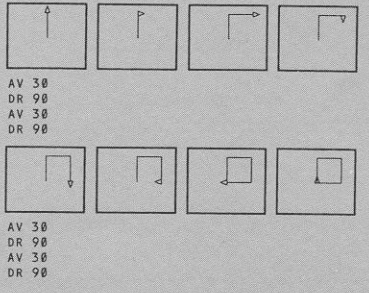
Africa, and Senegal in particular, criticize the West for a lack of interpersonal communication. The main worry with regard to computers is that their widespread introduction might lead to less communication. There is fear that ability to communicate — said to be one of the riches of the continent — might be threatened by this machine, the computer. □

Aliou Barry is a journalist with the Dakar daily, Le Soleil, *and is treasurer of the Association internationale des journalistes scientifiques africains.*

A TURTLE FOR YOUR THOUGHTS

According to the noted Swiss psychologist, Jean Piaget, children are the architects of their own knowledge and the learning of their mother tongue illustrates this. It is this innate gift of learning that computer scientist Prof Seymour Papert of New York has called "learning without teaching."

According to Papert, there is a "contradiction" between the human facility for learning language spontaneously and the inability of pupils to learn spontaneously in the classroom. On the basis of this contradiction, Prof Papert designed a computer language for children, known as LOGO. It enables the children to converse with an abstract turtle, represented on the computer screen by a small triangle that can be called up by hitting two specified keys. The child gives the turtle orders, i.e. programs it, and the turtle carries out the instructions if it receives enough information from the child. When the machine executes the instructions, images recognizable and meaningful to the child are produced.



Bouana Gaye, director of the research centre of the École normale supérieure de Dakar and head of the Computers in Education project in the Senegalese capital, describes LOGO this way:

"Children in contact for the first time with the turtle discover how they can animate it by typing commands to it on the keyboard. For example, typing the words 'ADVANCE 100' makes the turtle move 100 steps in a straight line, with each step measuring about 1 mm. 'RIGHT 90' tells the turtle to make a 90° right-hand turn. The pupils do not understand right away what the commands mean and they must make several attempts before they fully comprehend. But they are captivated by this kind of learning and are eager for repetition.

"With LOGO, programming the computer amounts to little more than teaching it a new word. Right from the beginning, children usually invent new words or variations of words for the computer. 'SQUARE' and 'TRIANGLE,' for example, might be written 'SQUA' and 'TRI.' These words enter the computer's memory and become points of departure for increasingly complex projects. Combining SQUARE and TRIANGLE produces 'HUT.' The child will try to put the TRIANGLE on the SQUARE. He or she will do it very naturally, but might unintentionally produce a HUT that is 'lying down' rather than 'standing up.' This is a bug or error, but a constructive one. Instead of inhibiting the child, as may be the case with traditional educational practices, the bug acts as a catalyst in the research the child is doing to carry out the project."