

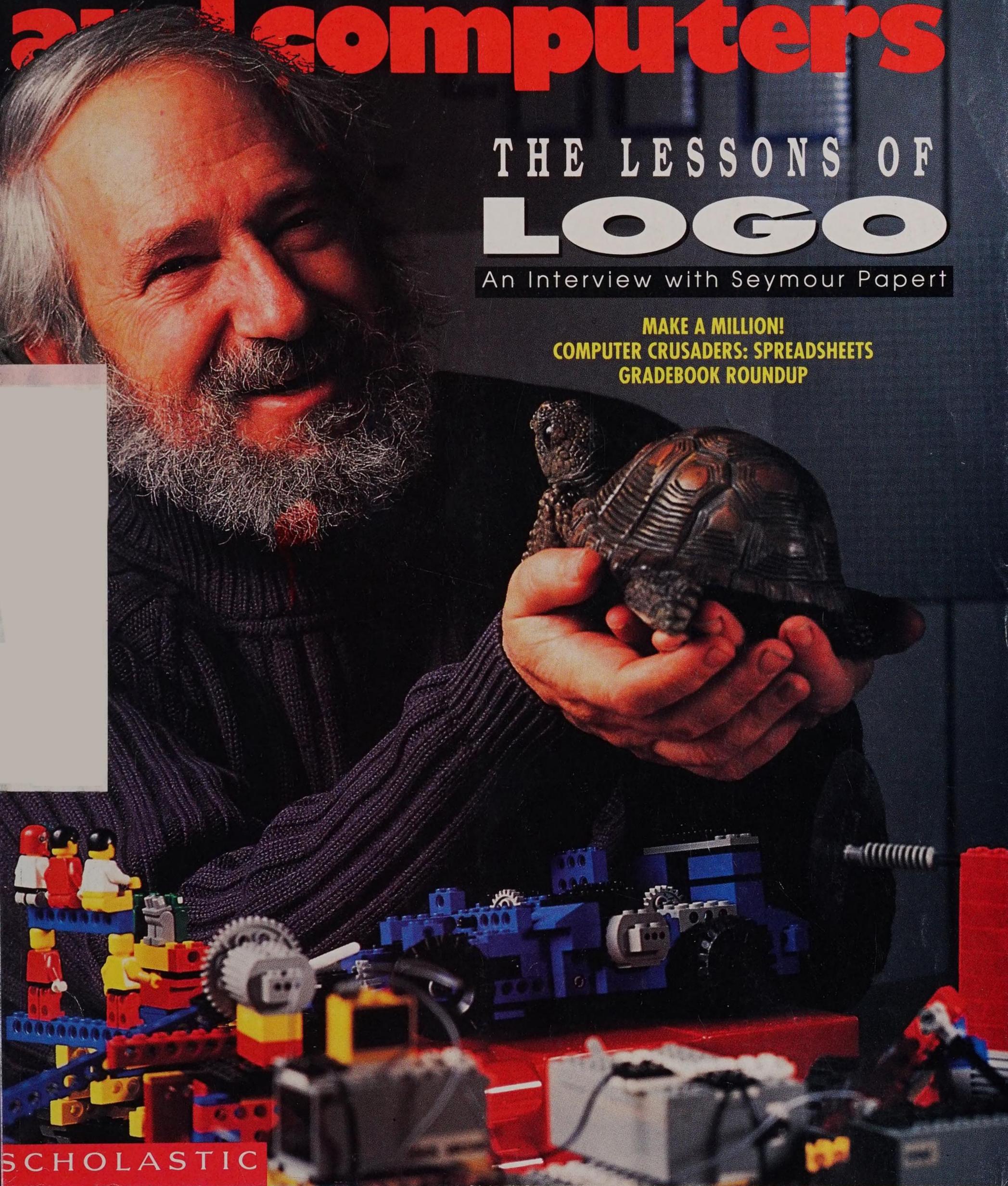
THE MAGAZINE FOR TEACHERS OF THE 1990s

# TEACHING and computers

## THE LESSONS OF LOGO

An Interview with Seymour Papert

**MAKE A MILLION!  
COMPUTER CRUSADERS: SPREADSHEETS  
GRADEBOOK ROUNDUP**



**I**t was almost 25 years ago that Logo—the first programming language for children—was born. Today, we have two other forms of Logo—LogoWriter and LEGO TC logo. Ten years ago, *Mindstorms: Children, Computers, and Powerful Ideas* fueled the fires for educators opposed to everyday teaching practices. Now, as *Mindstorms* is being translated into Russian, The 1990's version of it is in the works. What better time to hear from the man behind all of this—Dr. Seymour Papert?

Teaching and Computers' associate editor Louise Orlando recently spoke with Dr. Papert in his office at the Massachusetts Institute of Technology, where he is a professor of mathematics and education. Here is her interview:

▶ **HAS LOGO TURNED OUT THE WAY YOU EXPECTED, IN TERMS OF CLASSROOM USE AND STUDENT IMPACT? IF NOT, HOW HAS IT TURNED OUT DIFFERENTLY?**

At first, I used to be very upset when I saw schools using Logo in a rigid way, making it just another curriculum subject with a test, almost rote learning. I stopped being upset by that when I came to the understanding that [everyone] can use Logo as a personal mode of expression according to a personal style.

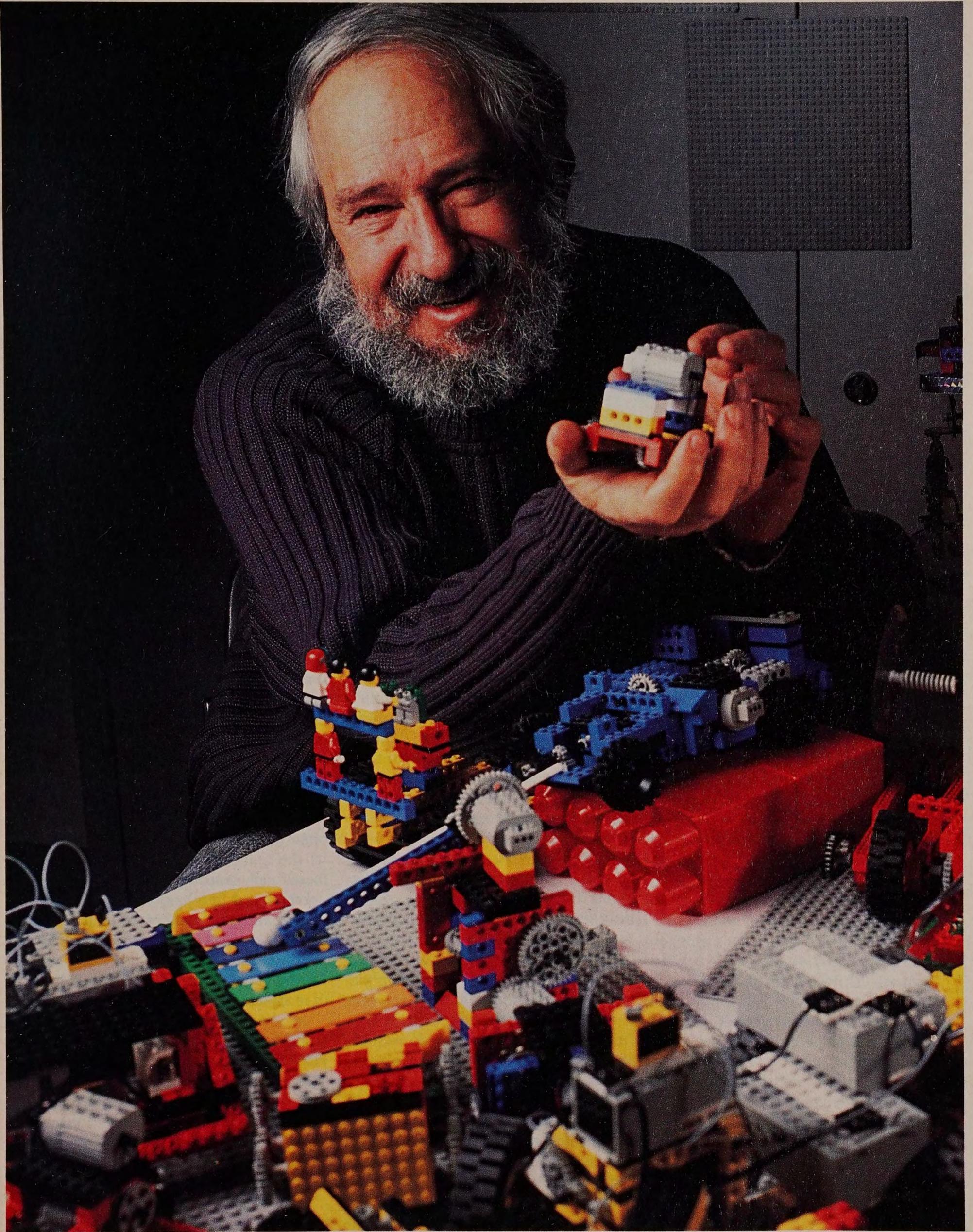
Many teachers believe in a very highly structured, teacher-centered, authoritarian [approach to] education. It's not surprising that they use Logo in this same way. It's not my business to try to persuade them to be different, because they should be who they are.

What I find most exciting, though, are teachers whose instincts are towards open education, encouraging individuality and creativity in children. I am pleased by the way that these teachers use Logo to do better what they have always been doing — teaching.

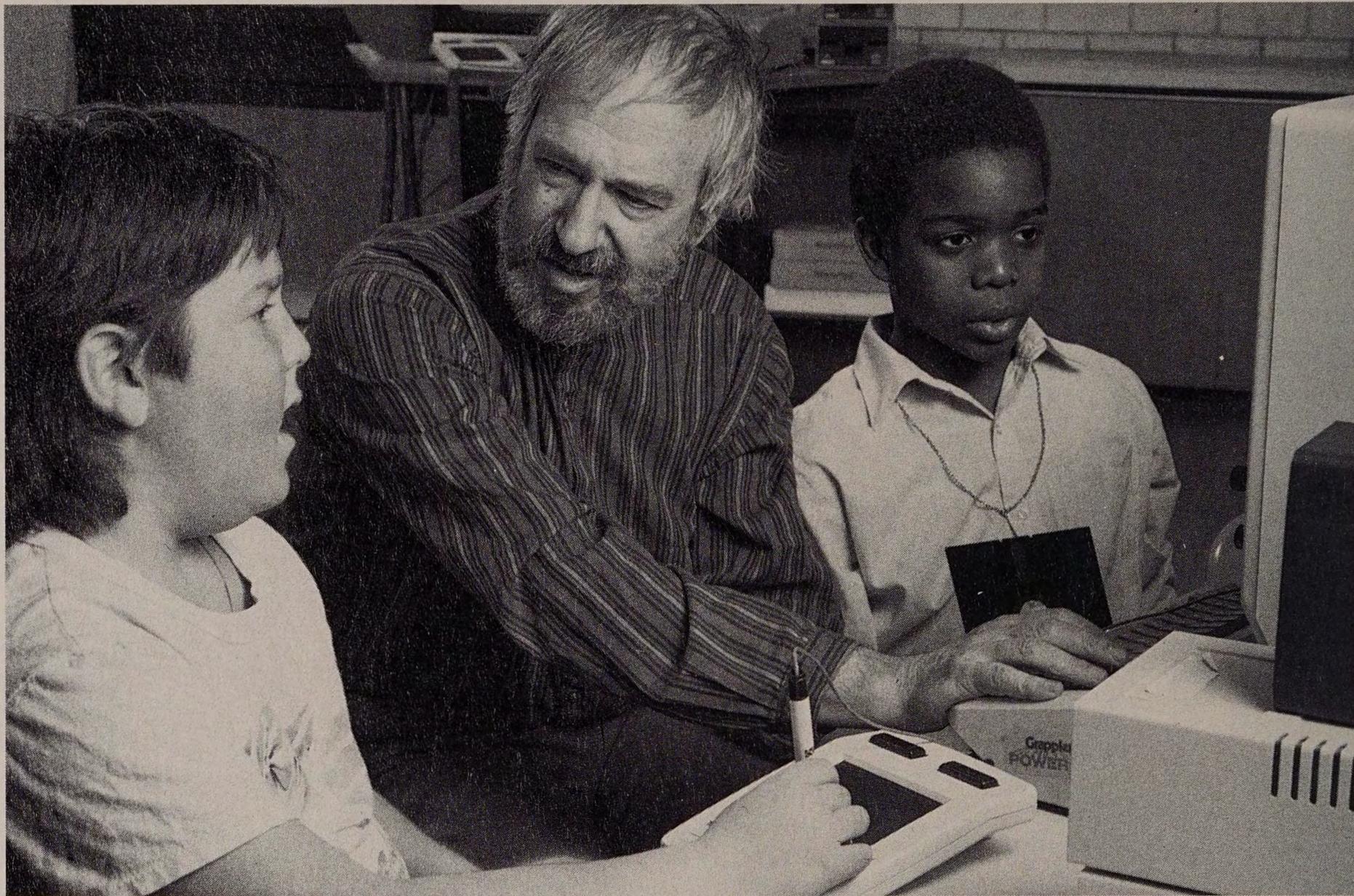
So the question doesn't have a simple answer. Some

BY  
LOUISE C.  
ORLANDO

# THE LESSONS OF **LOGO**



**Dr. Seymour Papert, creator of Logo and author of *Mindstorms*.**



Dr. Papert assists students as they work with Logo.



**I THINK THAT [IT IS]  
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aspects of what was expected [for Logo] are still for the future. Some aspects are being carried out wonderfully by teachers whose philosophy of life is compatible with the way I look at education, and I'm pleased with that. As for the teachers with philosophies not like mine, I shouldn't be surprised if they use Logo in their own way.

► **PROPERLY PREPARING TEACHERS TO USE COMPUTERS CAN BE DIFFICULT. WHAT DO YOU THINK ARE NECESSARY INGREDIENTS FOR SUCCESSFUL INSERVICE TRAINING?**

First of all, stop using the word training. Just consider, are you training the teachers to train the children? Everyone is horrified at the thought that we're "training" children. So why do we talk about training teachers? I think it's because, in the domain of technology, we think that all teachers have to do is implement something that has been set up by someone else. It's a mechanical process to know how to put the disk in and what to say to the kids—this is what calls for training. But what we need is something very different.

We need to encourage teachers to rethink what it is to be a teacher, what it

is to learn. With the possibilities for doing mathematics, science, and writing in very different, more integrated ways, some fundamental questions of philosophy open up for teachers. In the past, as long as we were only changing the curriculum very slightly, a teacher could say that mathematics was whatever was in the math curriculum. The opportunity for radical change [makes it] the teacher's business to rethink these fundamental questions.

I think that [it is] most important that principals take teachers much more seriously as thinkers and as activists, as people with a responsibility in society for change and not for implementation of ready-designed systems.

► **WHAT IS THE BEST WAY TO PREPARE TEACHERS FOR USING LOGO?**

The best preparation for teaching Logo in the classroom is to be very emphatic that we don't want to teach Logo in the classroom. We want to give teachers models—models in which Logo is used as a medium.

For example, I was just working on a project that involved fourth graders working four hours a day for three months. They were using *LogoWriter* to

make a piece of software that would explain something about fractions. Now what were these children learning? Were they learning about fractions, teaching, or how to approach and carry out a very complex project? Because everything happened together, the [components] gave meaning to each other. The children learned more in that time about each of the components than if the entire time had been spent on just one component. As a result, they improved quite spectacularly in their knowledge about fractions and they learned much more Logo than children usually learned.

So it illustrates a principle that sometimes learning more is much easier than learning less. It can be easier than learning each area separately. This is the kind of principle I see carried out by Logo.

➤ **WHAT ROLE DID THE TEACHER PLAY DURING THIS LOGOWRITER PROJECT?**

He or she acted as an advisor, conciliator, consultant, sometimes as a stimulator, and therapist [to ease frustrated spirits]. Sometimes when children tried to do something of great difficulty and didn't get the results they hoped for, the teacher gave them courage. I don't think the project could have happened or been nearly as successful without someone in that room. But what the teacher did not do was tell the students what to do. Instead the teacher only helped them do what they wanted to do.

➤ **MANY SCHOOLS CAN ONLY AFFORD TO PUT ONE COMPUTER IN EACH CLASSROOM. WHAT DO YOU SUGGEST IN THIS SITUATION?**

Some of the best things I've seen done with computers are by teachers who have one or two computers in the back of the room. This requires a great deal of teacher flexibility. The teacher must be laid back and a lot more "out of it" than when there are 20 computers in a lab with a student sitting at each one.

One or two computers in the classroom can be a bad situation, though. If a teacher or school administrator is too structured and won't let the students step away from the rest of the class to work on their own, it won't work.

➤ **THERE IS AN EDUCATIONAL TECHNIQUE KNOWN AS "SUPERLEARNING" THAT WAS DEVELOPED IN BULGARIA AND IS CATCHING THE ATTENTION OF EDUCATIONAL INNOVATORS HERE. THE**

**IDEA IS TO TEACH TO ALL OUR "INTELLIGENCES": LINGUISTIC, LOGICAL/MATHEMATICAL, INTRAPERSONAL, SPATIAL, MUSICAL, BODILY-KINESTHETIC, AND INTERPERSONAL. HOW MIGHT THIS TECHNIQUE COMPARE TO YOUR OWN THINKING ABOUT LEARNING?**

I can't comment on this technique specifically [but] I can comment in general that I think it's a profound weakness in our school structure that we fragment knowledge into disciplines and that we fragment children's learning time [accordingly]. I think it is important for education to go less toward fragmentation and more toward whole learning, where people learn through meaningful activities that are not chopped up into fragments.

So I think for learning to be really "super," it will have to break away from fragmentation. I think computers can be used in a way that will greatly facilitate that. I am very skeptical of anyone who came along with a technique of "super-learning" that can be implemented in a standard classroom with a standard curriculum. I think a curriculum and natural learning are really diametrically opposed to one another.

➤ **WHAT COMMENTS DO YOU HAVE ABOUT THE NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS' NEW STANDARDS CURRICULUM AND EVALUATION? HOW DOES LOGO FIT IN?**

I think they [the standards] are going in the right direction but they are incredibly conservative, from my point of view. But again, I'd make the reservation that if one has to work within the framework of schools as they are and curriculum as it is, maybe there isn't very much room for making radical change.

One of the ways in which the Council is conservative is that it does not make full use of a computer-based construction of learning. I think they would have done much better if they had originally integrated Logo into their proposals. But there is no question that an imaginative Logo-using teacher who wants to follow these standards can do it better with Logo.

➤ **SOME RESEARCHERS BELIEVE THAT TEACHING PROGRAMMING TO CHILDREN DOES NOT MAKE THEM BETTER PROBLEM SOLVERS AND THINKERS BECAUSE THE SKILLS LEARNED IN PROGRAMMING ARE NOT CARRIED OVER TO OTHER SUBJECT AREAS. WHAT DO YOU**

**THINK ABOUT THIS?**

I'm the first one to agree with this. These silly people [researchers] seem to be the ones who have misread *Mindstorms* as suggesting that teaching programming in itself will do any good to anybody. A large part of *Mindstorms*, in fact, is quite vehemently opposed to some programming.

I don't think that programming in itself is a particularly valuable activity. I do think that learning to program can open up very wonderful opportunities for children to do projects that lead to very good learning . . . to what you call superlearning.

I think one could say the same thing about reading. What's the effect of reading on children? Well, I think if you are reading wonderfully exciting spiritual poetry it will have one effect, and if you're reading violent horror stories it will have a different effect. So I don't think that reading has one particular effect and nor does programming have one particular effect, either good or bad. My criticism is not of [the researchers themselves] but of traditional educational psychology [which] tends to ask very narrow questions. If you want [to measure] small little effects, you only ask small-minded questions.

➤ **WHAT DO YOU THINK ABOUT COOPERATIVE LEARNING?**

I think it's very bad when students are forced to work in groups. But, when the collaboration comes around naturally, some of the best things happen. For example, there was one class that I was involved with that had a student that worked hard to be the very best at everything [particularly math]. As it turns out, when the class received computers, he wasn't the best anymore. This led him to get together with another student who wasn't as good in math but was very good in music. By getting together, what rubbed off in the long run was that they both got a much deeper sense of communication. This was a good example of a collaborative experience in which two kids did something that neither of them could do alone. This was different from making six kids work together who have nothing in common.

➤ **WHAT ARE THE BENEFITS OF USING LEGO TC LOGO AND LOGOWRITER?**

They don't have any benefit by themselves. I think these are very flexible,

expressive media that imaginative teachers and learners can use for a great variety of wonderful projects. [For example,] I think that a teacher who wants to give children the opportunity to do multi-media long-term projects is able to do this with *LogoWriter* much better than with traditional media like pencil and paper. It's not what Logo can do with children but what we can do with Logo.

➤ **TECHNOLOGY IS CONSTANTLY CHANGING AND IMPROVING. WHAT CHANGES DO YOU FORESEE TAKING PLACE WITH COMPUTERS BY THE YEAR 2000?**

The most important thing [about] the year 2000 is setting our sights. I think we see from the example that you mentioned—standards from mathematics teaching—that generally educators do not understand that computers play a big role in education. They see it as an add-on that's occasionally available for short periods of time.

In 1980, people thought it was wonderful if there was a computer in school. Today we take computers in schools for granted. If we see there are only six in a school, we think the school is pretty backwards and can't do very much. I think the standard today, though, is that there are enough computers in the schools for children to have access once or twice a week. So that vision for what is the appropriate amount of computers has changed a lot since 1980. I think by 2000 it will change again. I don't think that all children will have free access to computers, but there will be a sufficient number of

models in which children will have access to computers everyday for this to become accepted as a standard.

Another big change will be a greater computer culture among a greater number of teachers—as opposed to the present situation, where in very many schools there is one computer teacher and no other teachers really touch the computer or know very much about it. I think the standard model by 2000 will be that the ordinary classroom teacher will be using the computer [and have a greater understanding of it].

➤ **I KNOW THAT YOU TRAVEL A GREAT DEAL, VISITING SCHOOLS IN OTHER COUNTRIES. YOU'VE RECENTLY DONE EXTENSIVE WORK IN COSTA RICA. WHAT IS IT THAT YOU LEARN FROM THESE SCHOOLS?**

I find that I learn enormously by seeing differences in educational cultures in other countries. For example, in Costa Rica, I saw a project which is implemented in their schools that is unequalled by [schools anywhere else]. They've put about 2,000 computers in schools in the last 18 months. About one percent of American teachers have it so good.

One reason why it is so good is because it is a small country regarded by the world as sort of out of the mainstream — as a developing country. Developing, a funny word: since we [the U.S.] have “developed,” we [believe that we've] gotten there, and don't need to do anymore.

I see this Costa Rican project energized by a sense of mission. People feel

that they aren't putting computers in schools just to improve test scores, they are trying to develop and express a more energetic and optimistic vision of the future. I think this energizes the teachers to come into it [educational computing] with a much better understanding of it. No one is thinking of teaching Logo commands. The teachers, kids, parents, and the government, are all engaged in taking hold of the future. It's all this energy that I think we saw in the United States in the early days of the computer. I get refreshed by seeing Costa Rica. I'd like to bring to the U.S. educators a sense of this vibrant excitement.

➤ **WHAT OTHER PROJECTS ARE YOU CURRENTLY WORKING ON?**

I'm trying to write the book that would be for the 1990s what *Mindstorms* was for the 1980s. *Mindstorms* had a certain success because it articulated hopes and perspectives quite widely shared. There was a tremendous sense that this computer was something new and it was going to change learning. The people who were most enthusiastic about the book and got the most out of it were not looking for how-to stuff but for an articulation of a vision. I'm trying to write about that vision—a vision of a less fragmented, more constructive, child-centered education. Part of that vision is that somehow computers will make it easier for children to learn in a more natural, less constrained way, [and that] somehow the computer will be used by teachers and children as an instrument of creativity. ♡

## THE LOGO FAMILY TREE

What's Logo all about? Developed by Dr. Seymour Papert and his team in the mid-1960s, it is a computer programming language which lets the user direct the movements of a “turtle” (actually, a graphic triangle on the computer screen). Logo helps children learn mathematical concepts by “moving” objects as opposed to memorizing numbers.

Young children often learn how to use Logo by first moving a three-dimensional off-computer turtle model. Once children understand the “how” of movement, they use the computer to write simple programs telling the onscreen turtle to move, for instance, forward 20 “steps” (FD 20) and turn right at a 45 degree angle (RT 45). The steps that the turtle makes are drawn with lines on the computer screen and can be the building blocks of exciting graphics.

In 1986, Dr. Papert and a team of colleagues developed *LogoWriter*. *LogoWriter* incorporates Logo programming skills with a word processor. Users can move easily between components of the program, mixing graphics and text.

Dr. Papert next combined his programming language with the popular building toy, Lego bricks, to create *LEGO TC logo*. The first shipment of this programmable “toy” was in 1987. Users can build anything from merry-go-rounds to traffic lights and write simple programs to watch their creations move or blink on and off. (The Lego Corporation, incidentally, has endowed Dr. Papert's chair at MIT to allow him to continue developing Logo applications.)

# SPEAKING OF LOGO

## Interviews with Logo-Using Educators



*Linda Lindquist, fourth-grade teacher, Layton Elementary School, Wooster, Ohio.*

I began teaching four years ago. During this time I went to a few Logo workshops. I was sold on the creative aspects of doing animation and writing together.

One experience I had with Logo happened when I learned how to interface my computer with a tape recorder. I let three students [using *LogoWriter*] make their own animation that went along with their choice of music. We put the animation and music together and recorded it on a VCR. They essentially made their own music video using *LogoWriter*. Their timing and creativity were spectacular.

I had one student who was running for a class office use *LogoWriter* to make an advertisement for himself. He had helicopters buzzing over the school and a little boy walking. He flashed on the screen all the promises he was making for the kids.

At the end of the year, I make a slide show of students' work. I show it to incoming classes so they can see the different things *LogoWriter* can do.



*Marion Peiffer, integrated technology classroom teacher, Ardmore Elementary School, Bellevue, Wash.*

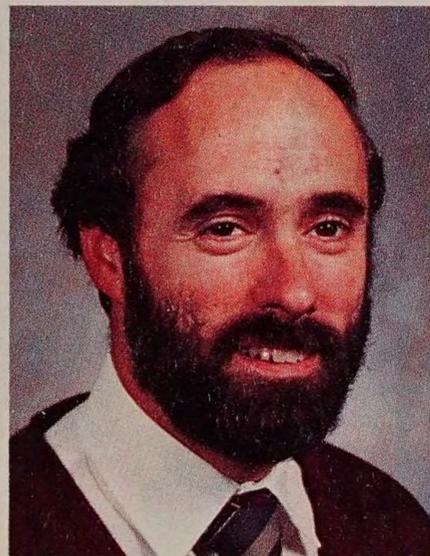
The exciting thing about Logo is that you can really watch kids think. You can see their thinking processes so clearly—something that you can't see when you use other problem-solving software.

The first Logo programs I used, about eight years ago, were *TI Logo* and *Cyber Logo*. *Cyber Logo* in particular . . . wasn't as easy to use as the newer Logo programs are.

*LogoWriter*, for example, is very easy for the kids to use. The word processor opens up the whole language arts field so you're not limited to just graphics.

*LEGO TC logo* is another

"microworld" we use extensively. We don't just follow the materials that are provided—instead, we do a lot of exploring. For example, we've done a lot of [testing] with cars on ramps, which gets us into motors. It is interesting to watch the students' development in this area, because when they first started last year as third graders, they knew they had to put the motor on the vehicles but they had no idea what the role of gears was. They would put the motor on and hook it up and expect somehow to transfer that energy to the wheels, which of course didn't work. It was a fascinating process to see them get that idea of the transfer of motion from the motor to the wheels.



*Paul Krocheski, computer specialist, Galtier School, St. Paul, Minn.*

This is a math and science magnet school for fourth, fifth, and sixth grade. We push to integrate science and math into other curriculum areas. [One example] where we use *LogoWriter* to integrate science, math, and language arts is our constellation unit. Every year our fourth graders study astronomy. We have students research a particular constellation that is apparent here during winter. They have to

represent the constellation on the computer, but to do this, they have to understand coordinate graphing. They write a Logo program that plots out their star points on the computer, as if it were the night sky. Then they write a report [explaining their project] with the word processing function. Finally, the students present their report orally, and show their constellation on the large screen projection system.

Our teachers working with *LEGO TC logo* will decide on a major theme project that will tie in with what students are learning in other classes. One year a sixth grade classroom was doing some work on community services and functions. Students were interested in how things were planned and taken to completion. [At the time,] there was a golf course under construction about a mile from the school. The kids walked there with cameras and notepads. They interviewed construction workers, found out about the machinery they were using, and returned to the classroom to design a golf course under construction using *LEGO TC logo*. They built the machines and constructed other props.

[Logo is introduced] in our school district with one full week (30 hours) of teacher training away from the classroom. *LEGO TC logo* teachers receive an additional week's training. St. Paul is unique because it's a district committed to Logo. [Our link to] Logo didn't develop through our technology department, but rather through our staff development department. It was seen as a way to change the way teachers teach and the way kids learn. ☛