Seymour Papert

(1928–2016)

Father of educational computing.

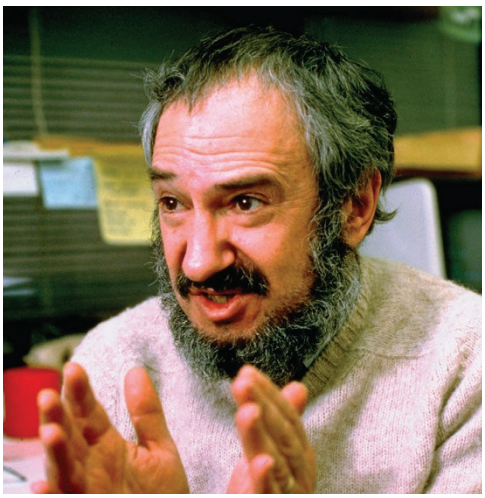
In the mid-1960s, when few people had even seen a computer, Seymour Papert was making it possible for children to use and program them. He spent his career inventing the tools, toys, software and projects that popularized the view of computers as incubators of knowledge.

Papert wrote three seminal books on using the computer to supercharge learning, aimed at academics, teachers and parents — *Mindstorms: Computers, Children, and Powerful Ideas* (1980), *The Children's Machine: Rethinking School in the Age of the Computer* (1993) and *The Connected Family: Bridging the Digital Generation Gap* (1996). Few academics of Papert's stature have spent as much time as he did working in real schools. He delighted in the theories, ingenuity and playfulness of children. Tinkering or programming with them was the cause of many missed meetings.

Papert, who died on 31 July, was born on leap day 1928 in Pretoria, South Africa. His father was an entomologist. Before he was two, he became enamoured by automotive gears that were lying around his home, which became the basis for early maths and science experiences. As an educator, he sought to help each learner to find his or her 'gears': objects or experiences they could mess about with, intuiting powerful ideas along the way. Papert believed that what gears could not do for all, the computer, the Proteus of machines, might.

Papert was repelled by apartheid. He ran afoul of the authorities by organizing classes for local black servants while in school. His anti-apartheid activities as a young adult branded him a dissident and prohibited him from travelling outside South Africa. He earned a bachelor's degree in philosophy (1949) and a PhD (1952) in mathematics at the University of the Witwatersrand in Johannesburg.

Without a passport, in 1954 he made his way to the University of Cambridge, UK, where he earned a second doctorate, in 1959, for work on the lattices of logic and topology. From 1959 to 1963, Papert worked at the University of Geneva with the Swiss philosopher and psychologist Jean Piaget. Their collaboration led to great insights into how children learn to think mathematically. Papert built on Piaget's theory of constructivism with a learning theory of his own: constructionism. It proposed that the best way to ensure that knowledge is built in the learner is through the active construction of something shareable — a poem, program, model or idea.



BILL PIECE/LIFE/GETTY

In 1963, artificial-intelligence (AI) pioneer Marvin Minsky invited Papert to join him at the Massachusetts Institute of Technology (MIT) in Cambridge. Papert was soon promoted to co-direct Minsky's Artificial Intelligence Laboratory. The pair co-authored the 1969 book *Perceptrons*; their mathematical analyses of how neuron-like networks comprised of individual agents could model the brain had a great impact on AI research. In 1985, Papert became a founding faculty member of the MIT Media Laboratory, where he led research groups on epistemology and learning and the future of learning.

Thinking about thinking and the freedom to achieve one's potential were the leitmotifs of his life. He wanted to create "a mathematics children can love rather than inventing tricks to teach them a mathematics they hate".

In the late 1960s, Papert was among the creators of Logo, the first programming language for children. One element that made Logo accessible was the turtle, which acted as the programmer's avatar. As mathematical instructions were given to the turtle to move about in space, the creature dragged a pen to draw a trail. Such drawings created turtle geometry, a context in which linear measurement, arithmetic, integers, angle measure, motion and foundational concepts from algebra, geometry and even calculus were made concrete and understandable. Mathematics became playful, personal, expressive, relevant and purposeful.

In 1968, Alan Kay, now known as the designer of what became the Macintosh graphical user interface, was so impressed by the mathematics that he saw children spontaneously engaged in at Papert's Logo lab at MIT that on his flight home, he sketched the Dynabook, the prototype for what became the personal computer. In 1989, Australian schools seeking to realize Papert's ideas began providing a laptop to every student. In 2000, Maine governor Angus King proposed providing a laptop for every 7th and 8th grader (typically 12–14-year-olds). Papert spent two years making the case across the state, causing popular opinion to override legislative resistance. The programme remains in place today. Papert was also an inspiration behind the One Laptop per Child initiative that has reached millions of children in the developing world.

A 1971 paper co-authored by Papert, 'Twenty Things to Do with a Computer' (see go.nature.com/2buuwe), marks the birth of the modern 'maker movement'. It describes a world in which children would create by programming inventions and experiments outside of a PC. In the mid-1980s, Papert and his colleagues made that world a reality with the first programmable robotics system for children, LEGO TC Logo. The name of LEGO's current line of robotics sets — Mindstorms — is a hat-tip to Papert. In 1989, LEGO endowed a permanent chair at the MIT Media Lab in his name.

Although critical of institutional schooling, Papert's research took place in schools, often with under-served populations of students. In 1986, he was invited to help Costa Rica reinvent its educational system, and from 1999 to 2002, Papert led an alternative, high-tech, project-based learning environment inside a prison for teenagers.

Papert dared educators to grow, invent and lead in a system prone to compliance and standardization. He argued that education is a natural process that blossoms in the absence of coercion.

In Papert's eyes, the computer was an object to think with. He built a bridge between progressive educational traditions and the Internet age to maintain the viability of schooling, and to ensure the democratization of powerful ideas. ■

Gary S. Stager *is the co-author of* Invent To Learn — Making, Tinkering, and Engineering in the Classroom, *and curator of the online Papert archive, dailypapert.com. He worked with Seymour Papert from 1986 to 2006.*
e-mail: gary@stager.org