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## Prophecy Fulfilled

*If, by a miracle of mechanical ingenuity, a book could be so arranged that only to him who had done what was directed on page one would page two become visible, and so on, much that now requires personal instruction could be managed by print.*

Edward L. Thorndike, a former AAAS president, wrote these words in 1912. Mechanical ingenuity, theories of learning, and industrial enterprise have now, 50 years later, fulfilled Thorndike's prophecy in the form of some 45 different kinds of commercially available teaching machines. Aware of this headlong rush for production, the National Education Association has just published a survey of the burgeoning young industry that produces teaching machines and the programmed courses of instruction for which the machines are designed.

The devices vary from an inexpensive book that doesn't prevent a student from peeking at page 2 before completing page 1 to machines costing thousands of dollars in which a computer makes the page 2 shown to a student who has muffed page 1 quite different from the page 2 shown to the student who has handled page 1 satisfactorily. The devices use different materials (books, cards, films, and others) and different responses (writing, typing, button pushing), and they are based on different educational and psychological principles. There is as yet but little research evidence to guide one in the choice of a particular device or technique. But there is much theoretical and empirical evidence that the basic idea is sound.

By the end of this year, one will be able to choose among 250 programmed courses in elementary, secondary, and college mathematics, 60 in science, 25 in electronics and engineering, 25 in foreign languages, 120 in social studies, and others in contract bridge, parliamentary procedure, fundamentals of music, and even in chess and etiquette.

The list will grow; techniques will become more standardized; research and experience will bring improvements; emotional reactions against anything called a "teaching machine" will dwindle; and the devices—or, more important, the programmed materials—will come into widespread and effective use.

But in the meantime there will be inept and inadequate programs, exaggeration of both advantages and limitations, and compromise between what is available and what might be achieved with further research and development. Let these processes go on, but let them not kill off the great development around which the confusion swirls, for the potential value is of the order of value of textbooks rather than film projectors or other teaching aids.

There are several reasons for watching this development with continuing interest. It is the first major technological innovation in education since the development of printing. It is based on theories of learning; the theory-to-practice sequence is not as rigorous as is common in the physical sciences and engineering, but a direct connection is nonetheless present. Widespread adoption will not only provide the student with the advantages of proceeding at his own pace and mastering page 1 before he turns to page 2, but will also force teachers to a higher plane of educational endeavor. The teacher who does little that a machine could not do better will obviously be an inferior employee to the one who uses machines to fulfill their functions and devotes his time and knowledge to going on from where the machines leave off. Teaching machines will enable teachers to become better teachers.—D.W.