experimental composition teaching techniques (Bradley, 1982; D. Suhor, 1982) and some interesting forays into reading based on schema theory (Schank, 1982)—a slim part of the computer movement in education—there is little in the movement that advances traditional literacy.

Computer jargon falsely suggests the creation of rich language environments. For example, many software materials are called "interactive." But the wholesome label most often points to simple-minded computer reasons like "Try again, Johnny!" It is precisely in the area of language and literacy skills that a research basis for the power of the computer in education is weakest.

Recently I examined dozens of prophecies about computers in education in light of the known capacities of computers as educational tools—especially, as tools for development of literacy skills (C. Suhor, in press). The predictions are wildly optimistic. Of course, they *might* come true. But the most interesting point about those statements that begin "by 1900 . . ." is that they are usually made by industrialists, materials developers, and others with a vested interest in new technologies.

I don't blame them for making such predictions, any more than I would have blamed Henry Ford (who debunked history, not prognostication) for predicting wonderful things for the automobile when he set up his first assembly line in 1913. The only prophecy worth making, I believe, is the self-fulfilling one, in which you predict with gusto and then work strenuously to make your predictions come true.

But such predictions should be given hard analysis and balanced by aggressive counterpredictions. The hard analysis will come, because educational movements operate according to a hulking dialectic in which no thesis ultimately escapes critique. As for counterpredictions, here are a few: I predict that educators will look industrial gift horses in the mouth. I predict that the educational technology that dazzles us today will be put to numerous tests of research, and weighed against traditional technologies and methods—the spoken word, for example—which will prove more "user friendly" than a joy stick. I predict that language arts computer materials will be produced with the learner's language growth in mind—no–nonsense materials that use graphics organically, not as gimmicks. I predict that easy phrases like computer literacy, computer languages, and interactive software will be deflated by simple semantic analysis, by sheer overuse, and by the disillusionment of those who come to know the actual range of human experiences covered by such terms. Finally, I invite researchers, administrators, and teachers to contribute toward the fulfillment of these predictions.□

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Computer Literacy

In the Alexandria, Virginia, schools, computer literacy has become as basic as reading, writing, and arithmetic.

DONALD E. DEARBORN

Recognizing that the explosion of computers in society has made computer literacy as essential as the basic skills of reading, writing, and arithmetic, the Alexandria City Public Schools in Virginia are going all-out to make their students and teachers computer literate. During the 1981-82 school year, Alexandria was one of three school systems in the country to pilot a K-8 computer literacy program developed by the HumRRO Corporation. The program calls for use of computers in language arts, mathematics, science, and social studies so that students are ultimately able to use the computer (1) as a tool in the instructional process, (2) to solve problems, and (3) in writing through word processing.

Problem solving and logical thinking are key components of the Alexandria program, which has four strands: history, concepts, process, and applications. Figure 1 shows activities covered at each grade level. Students in the fourth grade, for example, receive hands-on experiences in the "concepts" strand. Even kindergarten students are taught basic computer parts.

The district meets the equipment needs of this program through two laboratories, each containing 24 microcom-

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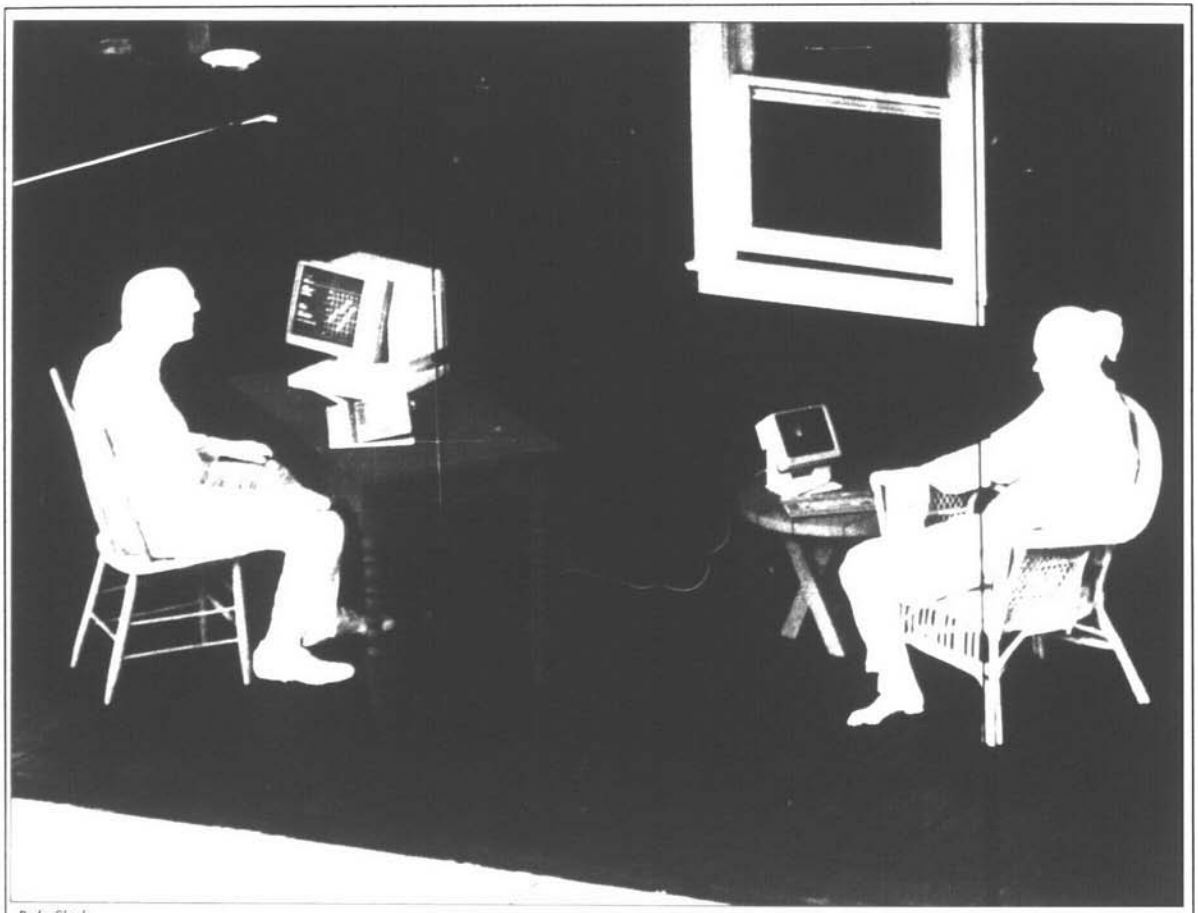
Figure 1. Alexandria Elementary Computer Literacy Program

Student Objectives	Grade Levels K	1	2	3	4	5	6
History							
1.1 Recognize different number systems			•	•	•	•	•
1.2 Learn about the history and use of non-mechanical calculators				•	•	•	+
1.3 Learn how an early mechanical calculator works					•	+	+
1.4 Recognize the advantages of the modern hand-held calculator					•	•	•
1.5 Learn how punched cards were used to program a machine						•	+
1.6 Learn how a system was developed for computing the census						•	+
1.7 Learn about main frame computers of the 1950s						•	+
1.8 Recognize the effect of the Space Age on the development of computer technology							•
1.9 Learn about the "mini" and "micro" computers							•
Concepts							
2.1 Understand basic computer parts	•	+	+	+	•	+	+
2.2 Have a knowledge of the function of special purpose keys (break, enter, shift, reset, clear, and so forth)					•	+	+
2.3 Use and understand basic computer terms	•	•	•	•	•	•	•
2.4 Have a knowledge that there are many computer languages							•
2.5 Know the basic operations of a computer system, including input, processing, and output	•	+	+	+	•	+	+
2.6 Understand the relationship of hardware to the basic operations of a computer system					•	+	+
2.7 Distinguish between logical and illogical activity	•	•	•	•	•	•	•
2.8 Know that machines are designed, built, and operated by humans to assist in specific tasks				•	•	•	•
2.9 Understand capabilities and limitations of computers							•
Process							
3.1 Follow a procedure for a familiar task	•	•	•	•	•	•	•
3.2 Describe a procedure for a familiar task	•	•	•	•	•	•	•
3.3 Recognize that different procedures produce the same results	•	•	•	•	•	•	•
3.4 Modify an existing procedure to perform a task			•	•	•	•	•
3.5 List and modify a procedure to perform a task					•	•	•
3.6 Read a simple flowchart				•	+	+	+
3.7 Draw a flowchart for a simple task					•	+	+
3.8 Use a prepared program in a microcomputer	•	+	+	+	+	+	+
3.9 Become familiar with the keyboard	•	+	+	+	•	+	+
3.10 Power up the computer					•	+	+
3.11 Load a cassette. Rewind and execute the program					•	+	+
3.12 Type in a prewritten program and execute					•	+	+
3.13 Use BASIC commands					•	•	+
3.14 List BASIC statements and commands							•
3.15 Use a computer as a calculator						•	+
3.16 Create a simple program in BASIC							•
Applications							
4.1 Discuss where computers are found and used in society	•	•	•	•	•	•	•
4.2 Identify how computer technology affects or influences life				•	•	•	•
4.3 Name fields in which computers are used and state how they are used					•	•	•
4.4 Describe some of the ways computers are used for gathering and processing information					•	•	•
4.5 Identify career fields related to computer development and use						•	+
4.6 Appreciate the value of computer skills for future employment							•

Key: • Concept taught
+Concept reviewed



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puters. Each of the 12 elementary schools uses one of the labs for nine weeks, allowing enough time to provide every student with in-depth use of a microcomputer. In addition, each school has a microcomputer permanently housed in the library media center and several others that teachers can use in their classrooms to reinforce the lab instruction.

Teachers also receive training in computer literacy in a 17½-hour course over a five-week period, which is led by computer-oriented staff within the school system. Teachers receive one unit of noncollege credit for completing the course, which can be used for certificate renewal. Figure 2 is an overview of the computer literacy course for elementary teachers.

Although the school system is pleased with its computer literacy program, it is prepared to revise, expand, and enhance it each year to keep pace with technology. □

Figure 2. Elementary Computer Literacy Course for Teachers

I. Computer Operations
- Computer Terminology
- Assembly/Disassembly of the Microcomputer
- Input/Output Devices
- Central Processing Unit
- System Commands
- Storage Devices
- Hands on

II. Computer Literacy Strands
- History
- Concepts
- Process
- Applications

III. How to Incorporate Into the Curriculum
- Curriculum Utilization
- Management of Computers

IV. Education Applications of the Microcomputer
- Computer Literacy
- Computer Science
- Computer-Assisted Instruction
- Computer-Managed Instruction
- Library/Media Center
- Special Education

V. Computer Programs
- Utilization of Prepared Programs
- Evaluation of Prepared Programs for Utilization
- Development of Programs
- Authoring Languages
- Management of Prepared Programs—Care, Cleaning, Copying

VI. Development of Problem Solving/Logical Thinking Skills