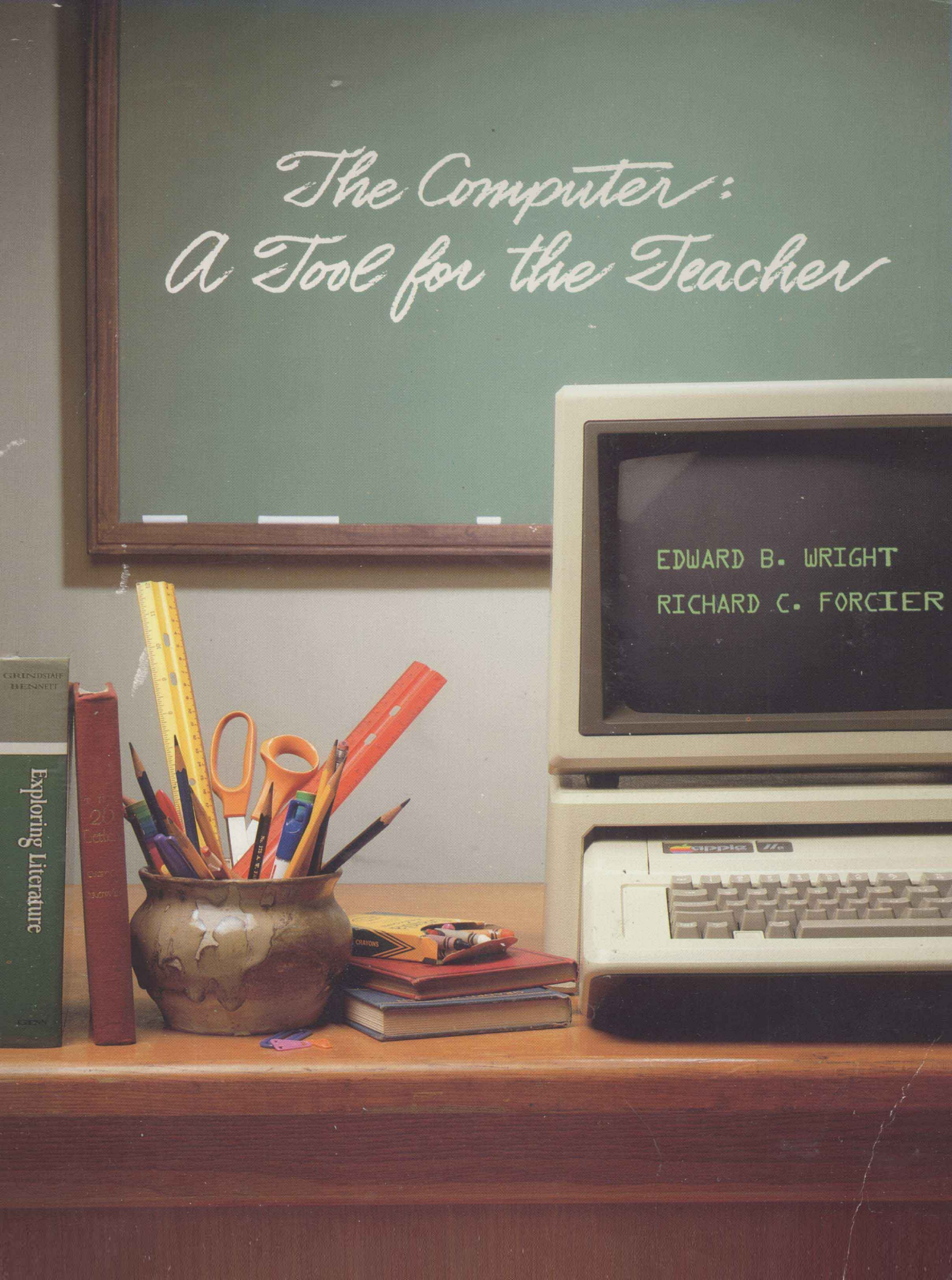
The Computer: A Tool for the Teacher



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Wadsworth Publishing Company
Belmont, California
A Division of Wadsworth, Inc.

Computer Science Editor: Frank Ruggirello
Production Editor: Jane Townsend
Interior and Cover Design: Andrew H. Ogus
Print Buyer: Barbara Britton
Copy Editor: Brenda Griffing
Technical Illustrator: Joan Carol
Cover Photograph: Marshall Berman
Cover Calligraphy: Sandra Bruce
Signing Representative: John Block

Printed in the United States of America

3 4 5 6 7 8 9 10 89 88 87 86

ISBN 0-534-04782-3

Library of Congress Cataloging in Publication Data
Wright, Edward B.
The computer: a tool for the teacher.

Includes index.
1. Education—Data processing. 2. Computer-assisted instruction. 3. Education—Computer programs—Purchasing. 4. Microcomputers. I. Forcier, Richard C. II. Title.
LB1028.43.W74 1985 371.3'9445 84-25687
ISBN 0-534-04782-3

Preface

We knew the ideal environment for writing a college textbook: a secluded, if perhaps musty, corner office in an ivy-covered brick building. Its remote location and lack of a telephone would effectively isolate the authors and would allow creative ideas to be translated into a manuscript. Search as we might, we could not find an ivy-covered building, much less one without a telephone. Ivy must not flourish in our climate. We settled on each of us working at home on our respective computers, using the same word processor and connected by modem over telephone lines. We exchanged paragraphs, sections, and chapters, revised each other's work, and transmitted the results back and forth over 65 miles until we achieved consensus. We should have had the foresight to have purchased stock in the phone company.

We wrote this book after four years of teaching a beginning-level computer course to undergraduates and in-service teachers who found themselves interacting for the first time in their professional lives with a computer in the classroom. We recognized our task as that of leading our students toward becoming computer-literate educators. We suggest that a computer-literate educator is one who *knows about computers:* that is, he or she is familiar with historical and current computer applications in society and in education. That person must *know how to operate a computer system*, possessing a familiarity with equipment and understanding its functions to successfully run commercial application programs. He or she must *know how and when to use computers* effectively, infusing them into the curriculum and integrating them with appropriate teaching strategies. Finally, the computer-literate educator should *know about programming.* He or she should be able to read simple programs and to evaluate program design.

Coverage

The Computer: A Tool for the Teacher provides instructors with a comprehensive and balanced text in educational computing. The book pulls together resources from the areas of learning theory, communication theory, curriculum development, lesson plan design, computer applications, practical computer operation, and BASIC and LOGO programming. It provides the reader with a straightforward introduction to the fundamental concepts needed to use the computer as an educational tool. In addition to introducing computers and how they can serve in the delivery of instruction, the book shows readers sample lesson plans that illustrate the practical use of computers. The text, with its accompanying TEXT UTILITY DISK containing sample programs, includes all the material needed to explore major issues in educational computing. Learning theory is reviewed to show that courseware must reflect awareness of how children absorb and process information. Curriculum is discussed to encourage the teacher to review courseware with an eye to where and how it will be used. Aspects of communication theory are presented to help the reader see the computer as an interactive communication device. The computing languages BASIC and LOGO are introduced in a nonthreatening, cookbook manner to provide the reader with an understanding of how programs are developed.

Flexibility

We have designed this book so that the following options can be exercised: (1) both BASIC and LOGO can be introduced, (2) languages can be assigned as supplementary reading, or (3) language sections can be omitted entirely.

To allow for these options, Chapters 2 through 7 are divided into two parts. Part One contains information on educational computing theory and practice, and Part Two treats LOGO and BASIC separately. LOGO and BASIC are developed in stages through the text to allow the reader to work with the languages over the entire term as their understanding of the subject matter increases.

Format

The task of any textbook is to provide the reader with information in a format that facilitates learning. To aid in that endeavor, we have included most or all of the following sections in each chapter:

- *Chapter Introduction.* To help focus the reader's attention, each chapter begins with a statement of purpose and a list of questions that are answered in the chapter.
- *Chapter Summaries.* Highlights of the material just covered are included where appropriate.
- *Chapter Exercises.* These help the reader to answer the questions presented in the chapter introduction through a practical application approach.
- *Chapter Glossary.* Throughout the text, important terms appear in boldface the first time they are discussed. They are also defined in the appropriate chapter glossary and are included in the glossary/index in the back of the book for easy reference.

Features

Major features of the theory and application sections include:

- A comparison of computer applications in society and in education.
- Use of the computer as a personal tool.
- Analysis of the roles of both teacher and student when using the computer.
- Classification of courseware.
- Selection of courseware.
- Development of evaluation forms for courseware review.
- Sample lessons plans illustrating use of the computer in practical applications.
- Use of the computer lessons.
- Courseware collection development and management.

Major features of the LOGO sections include:

- Concepts developed in stages, each chapter building on the preceding ones.
- A discovery point of view in which readers are encouraged to run the example programs and to experiment.

Major features of the BASIC sections include:

- Commands introduced that can be used immediately by readers who are asked to "Type the following" on a computer, if available.
- Each command illustrated by example.
- Error messages explained early on.

A program called ADDITION FACTORY is introduced in Chapter 3 and is further developed and enhanced in subsequent chapters, allowing students to apply new commands as they are presented. Challenge problems that relate to the commands but are replete with errors are presented at the ends of chapters for "de-bugging" by the student. Finally, students wishing to practice the skills learned in Chapters 4–7 can develop the optional program DRILL, which is presented in the back of the book.

Other Applications

The topics covered in this text would clearly be appropriate for a graduate or in-service course for practicing teachers. The material allows teachers to relate the use of the computer directly to the classroom and to develop materials appropriate for a specific teaching situation.

The emphasis of an in-service course could be on any one of a number of themes developed in the text: courseware evaluation, development of unit plans using courseware owned by a school district, an introduction to LOGO or BASIC for nonprogrammers, or an introduction to computer systems.

For a graduate-level course in educational computing, the student could investigate computer use with respect to learning theory, curriculum development, and communication theory. He or she could examine more closely the problems associated with implementing computers into existing classroom practices.

Acknowledgments

Many people provided valuable assistance in the development of *The Computer: A Tool for the Teacher.* We extend our appreciation to the manuscript reviewers whose suggestions have resulted in the improved reliability and teachability of this text: Les Blackwell, Western Washington University; J. Gordon Coleman, Jr., University of Alabama; William L. Deaton, Auburn University; William Dunaway, Jacksonville State University; Gary Ellerman, Radford University; William Jones, University of Wisconsin at Oshkosh; Jeanette V. Martin, New Mexico State University; Bonnie Mathies, Wright State University; John Wedman, University of Northern Iowa; James Wesson, Miami University; and Robert Wiederman, Corpus Christi State University.

In addition, our sincere thanks to the following individuals (in alphabetical order):

- Peggy Cummings Forcier, library administrator and wife of author Richard Forcier, labored many long and late hours editing the manuscript and offered constant support and encouragement.
- Lorraine Gabel, curriculum and instruction specialist, made a significant contribution in the research that went into the manuscript. Her work resulted in descriptions of the processes of curriculum development and integration of computers into the classroom. She suggested a number of the computer applications, wrote the CLOZE TEXT program included on the TEXT UTILITY DISK and field tested the manuscript in an in-service course taught to the administrators and teachers of the Dayton (Oregon) School District. To these participants, we also owe a vote of thanks.
- Jacqueline McCrady, assistant professor in educational technology, offered assistance in the organization of software resources.
- Cathi Rooth, school media specialist, provided valuable and constructive criticism as well as manuscript editing.
- Frank Ruggirello, senior editor of Wadsworth Publishing Company, offered constant support and occasional prodding. For those of you contemplating writing a book, Frank informs us that ivy must not flourish in his climate either, since all he has found in his search are adobe buildings covered with bougainvillea.
- Jane Townsend, production editor of Wadsworth Publishing Company, gave unselfishly of her time to see that deadlines were met.
- Catherine Whyte, doctoral student in educational technology and an authority on LOGO, contributed significantly to the LOGO language sections.

Contents

1 The Computer: Its Impact on Society and on Education

Introduction

This chapter presents a brief overview of computing, illustrates its impact on society, and surveys a variety of computing applications. Based on the premise that the educational environment is a microcosm of society, this chapter examines the relation of the computer's societal impact to its impact on education. The following general questions are discussed.

1. How are computers used in our society?
2. How are computers changing our society?
3. How are computers changing education?
4. Why should personal computing be incorporated into education?
5. How can computers be used in the classroom?

A Frame of Reference

As Society Changes, So Does Education

Viewing the educational process as a mirror of society's traditions, values, needs, and expectations, one cannot consider the impact of the **computer*** on education without examining the computer's broader societal impact. Schools have always reflected the processes characteristic of a society. At present, schools are structured to a large degree on

*Bold-faced terms are defined in the end-of-chapter glossary.

an assembly line model, a product of the Industrial Revolution. Classes begin at the same time, and movement from one class to another is done at fixed times. Such fixed time-block scheduling is intended to match groups of students with teachers; it is not chosen because it is the best learning arrangement for an individual student. As we move along in the Information Revolution, the way in which people communicate and interact will undergo a significant transformation. The organization of the school will change accordingly, as new technologies allow for other kinds of interfacing between student and teacher. If students are no longer bound by lockstep instruction, the able students will progress through instructional materials quickly. The slower students will also succeed, but at their own pace. The computer will not replace the teacher but rather will become a diagnostic, instructional, and management tool for the teacher to use in breaking the student free from the lockstep mode of class instruction.

Figure 1.1 Multifunction digital watch

The Microcomputer: A Pervasive Element in Our Society

Today a wristwatch is no longer just an instrument for telling time. You can hardly buy one with less than a half-dozen functions (Figure 1.1). How many grade school children have digital watches? Ask any of them for the time. You will hear "It's 8:57," not "It's almost nine o'clock." Responses like "It's about four thirty—nearer to quarter after four," have changed to "It's now 4:17." We are rapidly moving from **analog** thinking to **digital** thinking; that is, from comfortable approximations along a continuous scale to the exact precision required when dealing with a single digit.

Digital computers are currently being marketed as programmable process control devices. As microprocessors, they are embedded in many modern products such as calculators, automobiles (in diagnostic monitor circuits and emission regulators, and for carburetion control), home appliances (in refrigerators, stoves, microwave ovens, and television sets), and hand-held electronic games. The digital computer has become a part of so many products that it is considered just one of the components used in assembly.

Figure 1.2 A student using an Apple IIe to complete a homework assignment

Preparation for Everyday Life

What will students graduating in the year 2001 need to know? How will they best acquire that knowledge? We already know that we must prepare students for an everyday life in which computers figure more and more prominently. The digital computer has invaded our businesses. It is now making its presence felt in our schools and is bursting into our homes (Figure 1.2). Computers are going to assume more routine duties and will become as accepted as wristwatches in our daily lives. Preparation of students for everyday living involves using relevant materials. More than 10 percent of the homes in the United States have computers or **terminals** with access to remote **data bases**. By the year 2000, most homes will have computers and video phones. In addition to providing a vehicle for the delivery of education at a distance, computers will be used to access health monitoring and medical diagnostic information.

According to Christopher Evans,[1] the United States is moving out of the Industrial Revolution, which provided us with physical tools, and into the Cognitive Revolution, which is providing tools of the mind. Schools need to reflect upon and use wisely the tools of a cognitive society. Teachers and parents must help children learn to work and to live with the computer as a *tool*. This tool will be understood only through use. If one does not have the opportunity to use the personal computer as a tool, one may avoid it as one would avoid any device that is not understood. Yet without understanding, students may be out of step with society, or even limited in their potential growth.

Preparation for Careers

Career preparation has been traditionally viewed as an obligation of the schools. In what jobs will the students of 2001 be prepared to function effectively? According to figures released by the U.S. Bureau of Labor Statistics (undoubtedly with the help of a computer), three out of the five jobs expected to grow most rapidly during the next decade are in the computer industry. A fourth occupation, business machine repairer, is closely related. Computer science teachers and educational technology specialists have not yet made it onto this list, but surely they can't be far behind if public schools are to respond adequately to society's expectations.

What curricula will be necessary to educate the generation of students now entering school? Even our concept of occupations and professions is changing and will continue to change. When Adam Osborne,[2] founder of Osborne Computer Inc., was asked whether librarians would be needed in the year 2005, he answered a resounding "No."

> Librarians won't be needed as custodians of materials nor as guides to specific resources. If I want to know something, I'll simply plug into the worldwide network of data bases. Why do I need someone to do my searching for me, when my computer is such a snap to use? . . .

But he followed through with an equally emphatic "Yes."

> Librarians will be needed to organize the search through the labyrinthine networks. They will be needed to update the data bases that will so dominate that information-dependent society, and as facilitators to refine and simplify search strategies. They will be skilled in anticipating what people need to know, and in making sure it's available.

Our society has always searched for ways to get jobs done efficiently. When a task needs to be done and there is not enough time to perform it in the usual manner, we have always looked for an alternative method. Computers have been adopted by business because it is cheaper and quicker to do certain jobs with the computer than by hand. Many of the tasks computers do in the business world would be impossible to do manually. For example, in monitoring a production process, the computer collects data, rapidly analyzes them according to rules set down by engineers, and almost immediately reports any deviations detected. Such tasks cannot be done in the same time frame by people. Plant automation, which has come about with the aid of the computer, has improved the working conditions of the employees. The cost, however,