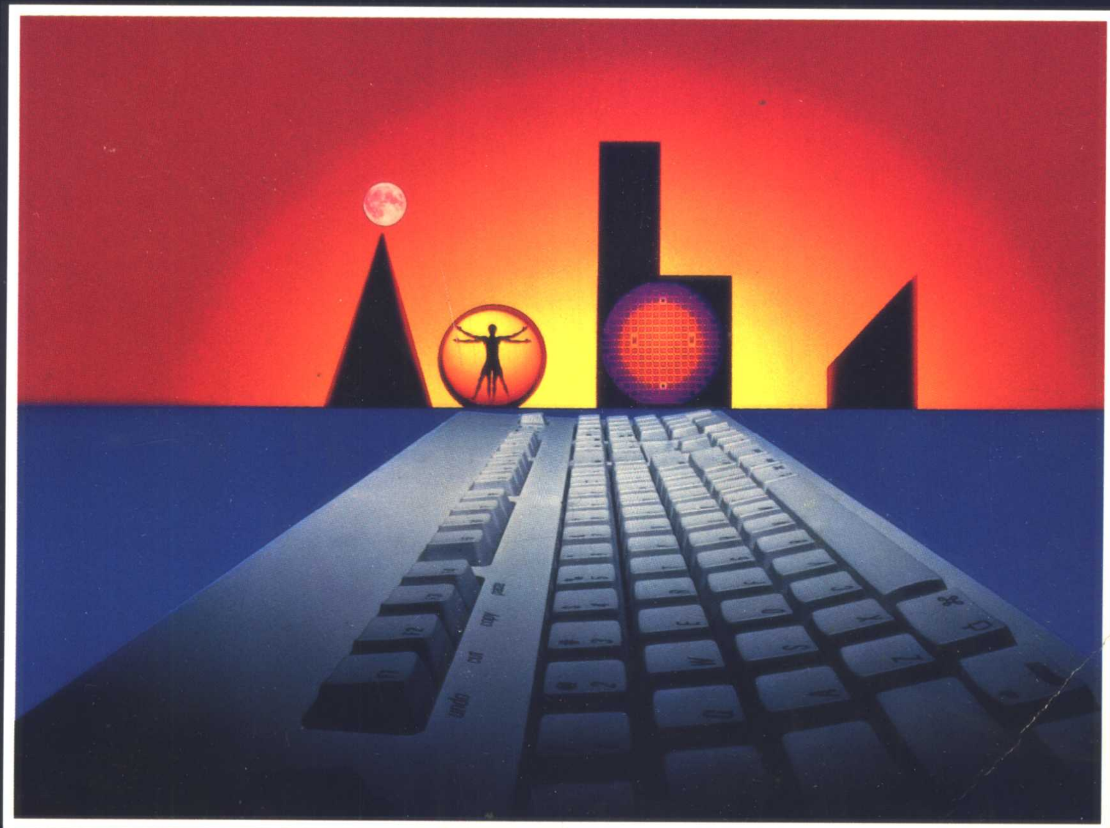
Robert S. Gold



MICROCOMPUTER APPLICATIONS IN HEALTH EDUCATION

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FOREWORD

One gropes for metaphors to capture the essence and historical significance of recent events. In both the health field and in technology the term *revolution* seems almost a cliché. Used to describe the second epidemiological revolution and the computer revolution, the word now pales in the face of the momentous political changes in Eastern Europe, the Soviet Union, South Africa, and some Third World countries. But the parallels among these three revolutions suggest some fascinating relationships.

Most of these uses of the revolution metaphor correctly suggest a certain redistribution of power. The second epidemiological revolution produced the self-care movement and the health-promotion policies and programs that transferred control and responsibility from professionals to patients, consumers, and lay citizens. The computer revolution made high technology readily accessible in the form of PCs, laptops and user-friendly software. The global democratic revolutions at the turn of the decade achieved a redistribution of political power.

The metaphor breaks down, however, when applied to the resources created by the new public health and the new computer applications. Political revolutions typically achieve a redistribution of existing resources, but they seldom in themselves create new resources. The new public health, with its greater emphasis on health education for the masses, citizen participation in planning, and individual empowerment to control the determinants of one's own health, has unleashed enormous resources for individual and community action to improve health. The old medical hierarchy remains largely intact, if somewhat reorganized and refinanced, but a parallel system of lay-health initiative and community-health promotion has emerged, involving multiple sectors beyond the health establishment.

Similarly the computer revolution has multiplied exponentially the power, speed, and accessibility of computing resources, as Robert Gold points out in the opening chapters of this book. The affordability of computers for the vast middle-income populations of Western and Pacific Rim societies with market economies has opened untold advantages to these people and to their nations. "Information is power," was stated as early as the creation of the Federalist Papers. James Madison argued the idea as a founding principle for the United States constitutional democracy, justifying a free press to arm the people with the information they needed to balance their voting power against the unfair advantage of the elite and privileged classes, with their greater access to sources of information. Some of the widening gap between the poor and the non-poor in Western societies in the 1980s might be attributed to the differences in their access to computers for retrieving, storing, and processing information. One of the tasks of the educational professions today is to "democratize" computers, making them still more accessible and user-friendly for the disadvantaged, and for those who serve them, to prevent a further widening of the information gap. This book addresses that need.

In health, as in other needs and aspirations susceptible to socioeconomic and information advantages, the poor of Western societies and the masses of most Eastern European, Soviet, and Third World countries have not had the full advantage of the computer revolution. Most of them have yet to experience the full advantage of the first epidemiological revolution, much less exposure to the health benefits of the second epidemiological revolution. The computer and its related technologies of information processing, printing, communications, and automation had not brought the fruits of modern health knowledge to these other countries. As the life expectancy of Western nations and Japan continued to improve dramatically after 1970, that of the Soviet Union actually declined. Something more than coincidence traces to the same era the explosion of microchip technology in the United States and Japan. Something more than happenstance accounts for the fact that the protection and pirating of that technology has been one of the most jealously contested commercial secrets of these nations and an object of CIA and Soviet spying in the last years of the Cold War. The microchip has made much of the difference between the haves and the have-nots within and among countries in the last two decades.

The World Health Organization has made "technology transfer" and "health education" two of the pillars of its global strategy of "Health for All by the Year 2000." But its caveat with respect to technology transfer is that the transfer must involve "appropriate technology," meaning technology that can be applied and managed locally to analyze and solve a people's own health problems. The caveat with respect to health education is that it must involve and enable people to take control of the determinants of their own health. These, then, are the challenges for computer applications in health today. This book offers hope that the challenge will be met.

Lawrence W. Green

PREFACE

Microcomputer Applications in Health Education is a book designed to provide an introduction to the potential uses of microcomputers in the field of health education. It was written for students preparing for a career in health education, and for those already practicing, who consider themselves novices in the professional application of computers. Experienced users may also find some new ideas and a worthwhile review of existing skills. The book covers a broad range of hardware and applications and has been written in an attempt to provide some new material to all health professionals.

Chapter 1 is a historical overview of technological developments in computer hardware and an examination of the ways in which computer technology has been applied to health education in the past. Chapters 2 and 3 examine various applications of what is often called personal-productivity software—database, word processing, spreadsheet, graphics, and communications. Chapters 4 and 5 provide specific applications of microcomputer technology to the practice of health education, including instructional uses and health assessments such as health-risk appraisal, dietary analysis, fitness assessments, and stress appraisals. Chapter 6 contains a brief overview of research and statistical applications, and of artificial intelligence. Chapter 7 describes some of the legal and ethical issues related to the use of technology in health education. Chapter 8 provides answers to some additional questions that are commonly posed by health educators, and concludes with an examination of developments on the horizon. Appendix A, perhaps the most important chapter in many respects, is a list of twenty-two exercises that can be used to teach or learn all the applications mentioned in the book. This chapter may be used as a guidebook or workbook for a course on microcomputer applications in health.

Each chapter provides a list of chapter objectives, key words, discussion questions, and recommended readings. A key feature of many of the applications chapters is a list of currently available software in that area. It is my hope that this book will answer some questions and provide some motivation for those not yet using this technology, and at the same time provide some new twists and information to those already involved with computers in the practice of health education.

Any book such as this requires the cooperation and assistance of others. I would like to thank Mim Kelly, Simon Priest, and William Montelpare for their contributions to chapter 6, Lisa Gilbert for her work

on the graphics section in chapter 2, and Glen G. Gilbert for his contributions to chapters 1, 2, and 4. A special thanks goes to the reviewers for their helpful comments and suggestions: Blair Irvine, University of Oregon; Bethany Shifflett, San Jose State University; Gerald Graf, San Diego State University; Ross E. Vaughn, Boise State University.

I would especially like to thank HT and Caitlin for their patience during this project, but most of all I would like to thank Barbara for her love and support. Without that support, this project could not have been completed.

Robert S. Gold, Ph.D. Dr. P. H. FASHA

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MICROCOMPUTER APPLICATIONS

IN HEALTH EDUCATION

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AN OVERVIEW OF COMPUTING

OBJECTIVES

By the completion of this chapter, the student will be able to

- understand basic terminology related to computer hardware and software;
- describe the major historic events leading to the availability of today's modern computers;
- summarize some events of historic significance in the application of microcomputers to health education;
- compare the characteristics of supercomputers, mainframe computers, minicomputers, and microcomputers;
- list the major capabilities and limitations of microcomputers for health education;
- identify the principal concerns regarding the use of computers in health education;
- summarize the range of potential health-education applications available to health educators.

KEY WORDS & PHRASES

Application software: Computer programs created for a specific purpose, such as word processing or data analysis.

Byte: The primary storage unit in the memory of a computer. One byte of memory holds the equivalent of one character of information (e.g., any letter, number, or symbol).

Computer: A general-purpose machine that processes data based on some instructions.

Hardware: A computer and all the physical equipment that is part of a computer system.

Mainframe computer: Large-scale computer system capable of storing hundreds of millions of bytes of information. Mainframe computers have the capacity to handle as many as several thousand users simultaneously.

Microcomputer: A small desktop-size computer, often called personal computer. Although capable of doing many of the same things as other computers, it is designed for use by one person. Generally costs less than ten thousand dollars.

Minicomputer: A midrange computer between mainframe and microcomputer. Minicomputers can support up to several hundred users. Cost in the range of twenty thousand to two hundred thousand dollars.

RAM: Random-process memory in a computer system. RAM is the primary memory in which information is stored by a user.

ROM: Read-only memory. ROM is memory that contains information that cannot be changed by the computer user. It generally contains information needed by the computer system to operate.

Software: Set of instructions that the computer follows. A series of instructions designed to serve a particular purpose or solve a particular problem is called *software program* or *program.*

Supercomputer: The fastest computers currently available. Capable of executing hundreds of millions of instructions per second supercomputers are used only for solving complex problems.

HISTORICAL OVERVIEW OF COMPUTING

When we consider the evolution of both communication and the use of information, several landmark events come to mind that have changed the course of human history. These events include

- the development of the spoken word;
- the development of the written word;
- the invention of the printing press;
- the invention of the telegraph machine;
- the invention of the typewriter;
- the invention of the telephone;
- the invention of the computer; and
- the development of microwave and satellite communications.

Many people consider these events revolutionary changes in our ability to manage and manipulate information and to communicate ideas. As we examine the history of computers and information management, we find it striking how many different events needed to occur before our present-day levels of communication could be achieved. Perhaps even more important is the notion that throughout history there have been many powerful machines available for these purposes.

Simkin (1987, p. 10) defines *computer* as any "electronic device with the ability to (1) accept user-supplied data; 2) input, store, and execute programmed instructions; 3) perform mathematical and logical operations; and 4) output results according to user specifications." At the current time there are at least four functioning types of computers, including *microcomputers, minicomputers, mainframe computers,* and *supercomputers.* Table 1.1 is a chronological list of some of the major events in the history of computers. Examine this chart with an eye toward several things: (1) the early availability of powerful computational devices; (2) the sequence of events that build upon one another; and (3) the rapid progression in technological advances made in your own lifetime.

It was not until the beginning of World War II that breakthroughs in technology speeded up—probably as a direct result of the need to ensure the rapid analysis of data necessary to fight a modern global war. It was during this time that *mechanical* and *electrical* components yielded to *electronic components.* Many notable milestones followed. Two worthy of particular note are

- 1943: John W. Mauchly and J. Presper Eckert developed ENIAC (the electronic numerical integrator and calculator). ENIAC contained eighteen thousand vacuum tubes and seventy thousand resistors, weighed more than thirty tons, and occupied a room eight hundred square feet in size. Dorf (1974) suggests that ENIAC could multiply two ten-digit numbers in three-thousandths of a second. This represented a remarkable breakthrough in computational power.