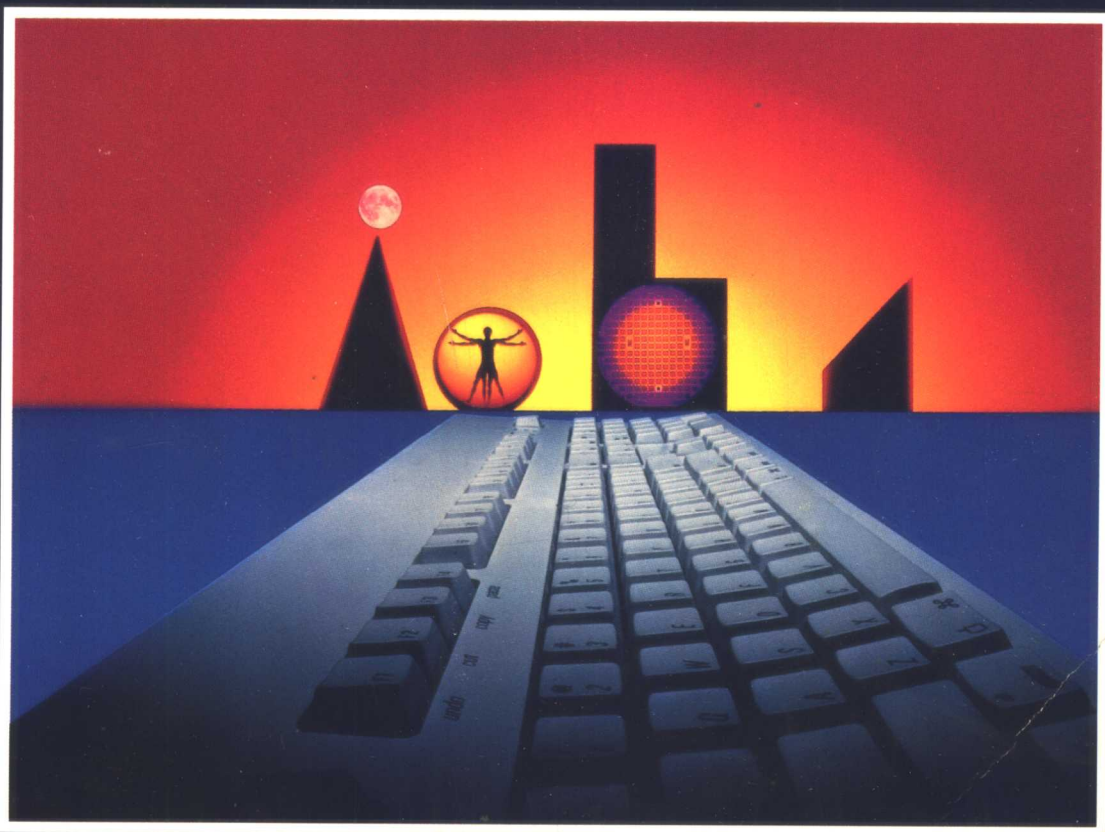


Robert S. Gold



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

CONTENTS

Foreword xv

Preface xvii

1 AN OVERVIEW OF COMPUTING 2

Chapter Objectives 3

Key Words and Phrases 3

*Historical Overview of Computing
4*

*General Capabilities and
Limitations of Computers and
Computer Systems 10*

Microcomputer Systems 10

Hardware 10

Microprocessor 10

Memory 12

Input/Output Devices 13

Auxiliary Memory 13

Software 16

Systems Software 16

Programming Software 18

Applications Software 19

*Historical Overview of Computing
in Health Education 20*

Milestones in Health-Education

Computing 20

Recent Technological Advances 22

*The Characteristics of Computer
Systems and Health Education
22*

Desirable Characteristics of

Microcomputer Systems 22

Undesirable Characteristics of

Microcomputer Systems 23

*Potential Uses of Microcomputers
in Health-Related Fields 26*

Summary 26

Discussion Questions 26

Recommended Readings 28

2 PRODUCTIVITY APPLICATIONS APPLIED TO HEALTH EDUCATION 30

Chapter Objectives 31

Key Words and Phrases 31

Introduction 32

*Database-Management
Technology 32*

An Overview of Database Concepts 35

Using the Database 41

*Another Example of Database
Technology 43*

Summary of Database Technology 46

*Case Study: The Maryland Database on
Drug-Treatment Programs 47*

*Word Processing Technology: An
Overview 48*

*General Capabilities of Word-Processing
Software 49*

Editing Capabilities 49

Formatting Capabilities 51

Mail Merge 53

Additional Word-Processing Utilities 55

*Summary of Word-Processing
Technology 55*

*An Overview of Spreadsheet
Technology 58*

Spreadsheet Formulas 60

"What-If" Projections 61

*Case Study: Managing Office Budgets
64*

*Summary of Spreadsheet Technology
64*

*Computer Graphics in Health
Education 64*

Functions of Graphics 65

Graphic Uses and Misuses 65

Graphics Software Availability 65

Producing Computer Graphics 67

Pie Charts 68

Fewer Charts/Line Graphs 68

Bar Charts/Column Charts 69

Tables 70

Diagrams 71

Design and Composition Decisions 73
Unity/Simplicity 73
Balance 74
Contrast/Emphasis 74
Proportion/Scale 74
Summary of Graphics 75
Summary 75
Discussion Questions 77
Recommended Readings 77

3 COMMUNICATIONS 78

Chapter Objectives 79
Key Words and Phrases 79
Introduction 80
On-line Services for Health Professionals 80
Bulletin-Board and Electronic-Mail Systems 80
Public-Access Databases 81
Interactive Applications 88
Metasystems 88
Communications in a Computer Environment 89
Communication Channels 89
Transmission Speed 89
Communication Protocols 92
Networks to Facilitate Communications 93
Telecommunications 99
Summary 103
Discussion Questions 103
Recommended Readings 103

4 INSTRUCTIONAL USES OF MICROCOMPUTERS IN HEALTH EDUCATION 104

Chapter Objectives 105
Key Words and Phrases 105
Overview Of Instructional Strategies and Principles 106
Instructional Applications of Computers 109
Training Health Professionals 109
Evaluation of Knowledge and Skills 113
Delivery of Health Education to Disparate Settings 113
Simulations 114
Evaluation of Computer Applications in Health Education 116
Informatics Computer Literacy for Health Educators 116
Evaluating Health-Promotion Software 117
Summary 124
Discussion Questions 124
Recommended Readings 124

5 HEALTH ASSESSMENTS 126

Chapter Objectives 127
Key Words and Phrases 127
Introduction 128
Health-Risk Appraisals 128
Some Background on Health-Risk Appraisals 129
Applications 131
Some Problems and Warnings 131
Dietary Analysis 133
Assessment of RDAs 136
Why Conduct a DINE Nutrient Analysis? 137
Validity and Reliability of DINE 144
Computerized Dietary Analysis: An Assessment 145
Problems and Warnings Related to Dietary Assessment 146
Fitness Appraisals 148
Measurement of Fitness and Exercise Capacity 148
Fitness and Exercise Prescriptions 151
Surveillance and Monitoring 151
Problems and Warnings 152
Stress Management and Coping 153
Computers in Psychology/Psychiatry 154
Effectiveness of a Self-Help Strategy for Stress 154
Problems and Warnings 155
The Potential for Using Assessment Software as Instructional Applications 156
Summary 157
Discussion Questions 157
Recommended Readings 157

6 ADVANCED TOPICS IN MICROCOMPUTING 158

Chapter Objectives 159
Key Words and Phrases 159
Introduction 160
Research Design and Management 160
Project Management 161
Artificial Intelligence and Statistical Decisions 162
Selection of Statistical Tests 162
Sample-Size Determination 163
Random Selection and Random Assignment 163
Implementing a Research Project 163
Data Acquisition 163
Data Analysis 164
Reporting the Results 164
Decision Assistance 164
Overview of Artificial Intelligence 167

*Implications and Trends for Health
Educators 168*
Summary 169
Discussion Questions 169
Recommended Readings 169

7 LEGAL AND ETHICAL ISSUES 170

Chapter Objectives 171
Key Words and Phrases 171
Introduction and Overview 172
*Liability for Personal Injury Caused
by Defective Programs 172*
*Regulation of Health-Related
Software 173*
*Privacy and Confidentiality: A
Conceptual Overview 174*
*Legislation and Policy Regarding Privacy
of Information 175*
Data Security 176
Computer Crime 180
*Ethical Issues in Health Computing
183*
Summary 184
Discussion Questions 185
Recommended Readings 185

8 EPILOG 186

Chapter Objectives 187
Key Terms And Phrases 187
*Some Final Questions Answered
188*
*What Can We Expect in the Future
for Health-Education
Applications? 191*
*Some of the Potential for Health
Educators 194*
Summary 195
Discussion Questions 196
Recommended Readings 196

APPENDICES 197

A Applications Exercises 197
B References Cited 235
*C Vendors of Health-Promotion
Software 243*
*D Sources of Information on Health
Applications 249*
E Selected References 251

GLOSSARY 271

CREDITS 281

INDEX 283

List of Figures

1.1	Graphic of microcomputer system and its components	11
1.2	Graphic representation of computer memory	13
1.3	Graphic images of input and output devices	14
1.4	Graphic images of storage scheme on floppy diskettes	16
1.5	Relationship between software types	18
2.1	The structure of a hospital information system	34
2.2	Sample data form	36
2.3	Computerized input format	39
2.4	Flat-file and relational databases	40
2.5	Hierarchical database structure	41
2.6	Reporting function of database systems	43
2.7	Sample letter produced in a word-processing environment	50
2.8a	Section of modified letter to WSHPP Participants: Global search and replace	50
2.8b	Section of modified letter to WSHPP Participants: Cut and Paste	50
2.9a	Modified letter with addition of page composition in word processor	52
2.9b	Modified letter with addition of page composition with desktop-publishing capabilities	53
2.10	Mail-merge form letter	54
2.11a	Anatomy of an electronic spreadsheet: Structure of a spreadsheet	59
2.11b	Anatomy of an electronic spreadsheet: Illustration of different entries in a spreadsheet	59
2.12	A spreadsheet for a survey research project	60
2.13	Sample pie-chart format	69
2.14	Sample fever-chart format	70
2.15	Sample bar-chart format	70
2.16	Sample diagram format	72
3.1	Analog versus digital signals	90
3.2	Distinctions between serial and parallel data transmission	91
3.3	Basic network configurations	96
3.4	Three types of modems	102
5.1	The DINE System	135
5.2	Nutrition-improvement schema	138
5.3	Entering personal information	140
5.4	Entering food choices	140
5.5	DINE printout: Analysis	141

5.6	DINE printout: Additional values	141
5.7	DINE printout: Verification	142
5.8	Nutrient search	144
6.1	Format for a Gantt chart	162
6.2	Format for a PERT chart	162
7.1a	Strategies for backing up data: Duplicate copy	179
7.1b	Strategies for backing up data: Generations of master files	179

List of Tables

1.1	Chronological history of computing devices	6
1.2	Mainframe computer generations	7
1.3	Personal computer stages	9
1.4	Clock speed of some common microprocessors	12
1.5	Peripheral storage devices for microcomputers	17
1.6	Potential applications of microcomputers in health education	27
2.1	Selected current application of information-systems technology in health settings	35
2.2	Raw data collected by WSHPP	37
2.3	Using the database	42
2.4	Page composition in a word-processing environment	51
2.5	Selected features of word-processing software	58
2.6	Partial listing of currently available graphics software	67
2.7	Sample table format	71
3.1	Bulletin-board systems for health-education professionals	82
3.2	Sources of on-line information	83
3.3	Vendors providing access to on-line databases for health professionals	87
3.4	Interactive telecommunications applications for health professionals	88
3.5	Metasystems for health professionals	89
4.1	Instructional uses of computers—a continuum	110
4.2	The extent of use of microcomputers in graduate health education training programs	111
4.3	Selected list of training software for health professionals	112
4.4	Selected list of CAI software	115
4.5	Sample goals and objectives for an introductory computer-literacy course for health educators	119
5.1	Ten leading causes of death by age, gender, and race	132
5.2	Selected list of health-appraisal software	134
5.3	Selected list of dietary-analysis software	147
5.4	Selected list of fitness-assessment software	150
5.5	Selected list of body-composition-assessment software	151
5.6	Summary of literature on the use of computers in psychology/psychiatry	155
5.7	Selected list of stress-related software	156
6.1	Statistical routines currently available in microcomputer applications	165
6.2	Selected research, statistical, and epidemiological analysis packages	166
7.1	Legislative attention to privacy of information	176

List of Exhibits

2.1	Distinction between data and information	33
2.2	Case example of database technology	44
2.3	Illustration of hypertext technology	46
2.4	Desktop publishing	52
2.5	Using mail-merge capabilities to produce a reference list	56
2.6	Sample graphics, fonts, and type sizes	66
2.7	Sample graphic preparation	76
3.1	Summary of communication terms	94
3.2	Site licenses and file servers	95
3.3	Setting up an office network	100
4.1	Integrating computer use with the health-education curriculum	112
4.2	Why so little health-promotion software	115
4.3	Educational specialization in nursing informatics	118
4.4	Quick health-promotion software review	121
4.5	Checklist for evaluating instructional software	122
5.1	Theoretical definitions of screening	129
5.2	HHA/HRA: Misinterpretation waiting to happen	135
5.3	Dietary goals of the United States	137
5.4	Illustration of application of dietary analysis	147
5.5	Case example—Fitness assessment	152
5.6	Coping with stress—An 11 part program	156
7.1	Are standards of practice enough?	177

MICROCOMPUTER APPLICATIONS

I N H E A L T H E D U C A T I O N

Robert S. Gold
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Wm. C. Brown Publishers

1

AN OVERVIEW OF COMPUTING

O B J E C T I V E S

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.

K E Y W O R D S & P H R A S E S

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.