DOCUMENT RESUME

ED 229 867 EA 015 650

TITLE	Computer Literacy. CSBA Task Force Report.
INSTITUTION	California School Boards Association, Sacramento.
PUB DATE	Nov 82
NOTE	89p.; Prepared by the Computer Literacy Task Force.
AVAILABLE FROM	Publications, California School Boards Association, 916 23rd Street, Sacramento, CA 95816 ($5.50).
PUB TYPE	Guides - Non-Classroom Use (055) -- Reports - Descriptive (141)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Boards of Education; *Computer Literacy; *Computer Oriented Programs; Computers; Curriculum Design; *Curriculum Development; Curriculum Enrichment; Elementary Secondary Education; *Program Descriptions; Purchasing; State Surveys
IDENTIFIERS	*California

ABSTRACT

To help California school board members make informed decisions about computers, this handbook offers a computer primer with examples of outstanding computer curriculum programs. Chapter 1 introduces basic computer terminology. Chapter 2 outlines issues to consider in computer acquisition and the initial implementation of computer curricula. The second chapter also gives guidelines for evaluating the individual acquisition needs of a given district. Summaries of 7 other exemplary programs selected from the over 75 districts responding to a statewide survey are also provided. The fourth chapter briefly describes how a computer works. Included in the report are diagrams of the computer process and computer systems, tables showing test score improvement through computer use, a summary of avoidable pitfalls in computer purchasing, and a list of criteria for identifying outstanding computer curricula. Three appendixes contain a glossary of computer terms, definitions of 8 computer languages, and a chart summarizing the computer programs of the surveyed school districts of 27 counties; the chart includes names of contact persons, computer types used, and grade levels involved in the programs. (JBM)

Computer Literacy

CSBA Task Force Report On

Computer Literacy

Published by the California School Boards Association • November 1982

Computer Literacy Task Force Members

Forrest W. Williams, Chair
Oak Grove Elementary School District

Richard Daley
Oak Park Unified School District

Brian Lake
Huntington Beach Union High School District

Mary Lundstrom
Glendora Unified School District

Carl Raggio
Glendale Unified School District

Elizabeth H. Luckenbill (Adjunct)
South Pasadena Unified School District

Nancy Baumann
CSBA Staff Consultant

Cindy Phipps
Word Processing

Communications Unit

Elaine Levy, Editor
Jeanne DeWitt, Graphic Production

Jan Parrott
Director of Communications

**Published by the California School Boards Association
Sacramento, California, November 1982.**

This document was largely produced by computer. It was written and edited on a Wang word processor and typeset on an AM Varityper computerized typesetter.

CSBA BOARD OF DIRECTORS-OFFICERS

President: EUGENE SHIRLEY, Herlong ESD
President-Elect: SALLY STEWART, Portola Valley USD
Vice-President: DON HUNSAKER, Grossmont UHSD
Immediate Past President: MAXINE FROST, Riverside USD
Executive Director: Dr HERBERT E SALINGER

DIRECTORS

Region 1: MATHEW SANTINO (83), Eureka City High
Region 2: ROBERT STORTZ (82), Weaverville Elementary
Region 3: DONNA HEINE (83), Napa Valley USD
Region 4: MARY STARK (82), Auburn Union Elementary
Region 5: EUGENE HOPP (83), San Francisco Unified
Region 6: KAY ALBIANI (82), Elk Grove Unified
Region 7: WARREN EUKEL (83), Walnut Creek Elementary
Region 8: SANDEE BOESE (82), Merced City SD
Region 9: FORREST WILLIAMS (83), Oak Grove ESD
Region 10: RALPH TAYLOR (82), Central Union Elementary
Region 11: JANET LINDGREN (83), Oxnard Union High
Region 12: EARL O SMITH (82), Standard SD
Region 13: JO ARNESON (83), Hacienda-La Puente Unified
Region 14: JOE DUARDO (82), South Whittier SD
Region 15: ROBERT LINDSAY (83), Centralia Elementary
Region 16: JANET MISHODEK (82), Yucaipa Jt. USD
Region 17: DIANNE S JACOB (83), Jamul-Las Flores USD
Region 18: BILL INGRAM (82), Perris Union High
Region 19: DEAN McCORMICK (83), Orange County
Region 20: Dr. JOE DOBBS (82), Santa Barbara CCD
CAROL ENOS (82), Rancho Santiago CCD

DIRECTORS-AT-LARGE

Black: BRENDA JONES (82), Woodland Jt. USD
Mexican-American: MARY ROCHA (82), Antioch USD
Other Minority: KEITH CHUN (82), Fresno Unified

NSBA Director: DANIEL TOWLER, Los Angeles County Board

Table of Contents

Introduction

During 1981-82, CSBA formed a Computer Literacy Task Force to examine the use of computers in education and to determine what board members need to know to become literate about their uses. The charge to the Task Force was two-fold:

1) Examine the feasibility of a computer curriculum

2) Find examples of outstanding computer curriculum programs by surveying existing practices

The task force, in order to fulfill its charges, added a third charge: What Board Members Need to Know About Computers.

Literally a flood of material on computers is available. Rather than reiterate volumes of confusing information — which may become obsolete with the next technological advance — the task force attempted to provide a basic knowledge of computers so that board members can make more informed decisions about their use as a curricular option.

The essence of this report then is to assist board members, the decision-makers, in discussing and in making informed decisions about computers. The WHY and HOW questions must be fully explored by each individual district. To help with that exploration, an attempt has been made here to enable the reader to achieve some level of computer literacy.

The information will be valuable even in districts which have already taken the first steps or have already acquired elements of a computer system.

Before the study really progressed, the task force discovered there were some basics about computers and related concerns that needed to be discussed. A computer primer was developed in response to this need that will assist board members in becoming familiar with computer terms, concepts and applications.

Chapter I and the glossary in Appendix A attempt to give the board member a working knowledge of computers and computer terminology in order to make the necessary decisions.

Chapter II outlines the necessary issues to consider in the acquisition (through implementation stages) of a computer curriculum.

Armed with this information, board members are ready to take the first steps toward computer acquisition.

What the district wants to do with a computer is the prerequisite question to all your other acquisition questions. This needs assessment provides guidance for selection of appropriate software and hardware, for implementing a viable staff development program and, most importantly, to help ensure that learning takes place.

Guidelines for evaluating such programs are delineated in Chapter II to allow districts to integrate this evaluation component into their overall curriculum evaluation.

To find examples of outstanding computer curriculum programs, the Computer Literacy Task Force requested, from all school districts in California, information regarding computer usage in the schools The response to this request was phenomenal with over 75 districts sending information on their computer's administrative/record-keeping applications, its use as a curriculum aid and the use of the computer in a separate curriculum (See Appendix C, page 75.)

Individuals and other groups throughout the country provided additional information concerning computer usage in schools.

From all the reports and data received, the task force was able to identify exemplary computer programs. Although there are many well-developed and well-implemented programs in California, this report focuses on those that provide a good cross-section of models which schools may use to consider in the development of a computer curriculum or to compare to existing ones (see Chapter III).

Due to the volume of available information and the constraints on the study, there are some important issues that were not addressed but should be considered.

The task force did not address vocational education and saleable skills Computer curriculum programs, either integrating the computer into the existing curriculum or making computers a separate curriculum (i e. programming), are the major focus of this study.

Perhaps the most important consideration is the social equity issue We are moving from a society that recognized the Have and Have-Nots to a society of the Know and Know-Nots. This could have serious effects on American society as a whole and may even lead to the greatest societal crevasse to date.

Education is the answer and must be a leader in the technological revolution and its conscience in ensuring a quality and relevant learning experience.

The technology is here! The educational applications are here! We must become computer literate, our technological society demands it There are no options if public schools are to properly prepare their students for the 80's and beyond.

Chapter

What Board Members Need To Know About Computers

"If we are to reap the benefits of science-driven industries,
we must develop a computer-literate society."

Andrew Molnar, author and educator (1978)

Chapter I
What Board Members Need to Know About Computers

The last quarter of the 20th century is the Computer Age. The educational community has a responsibility to be an integral and vital part of this information explosion. Directly or indirectly, computers are part of our daily lives and we must be aware, at the very least, of what is happening around us and of what has and will continue to have great impact upon us.

Much has been written concerning computer literacy, but the definition is still as confusing as ever. It means different things to different people. Computer literacy for students is different from that of board members, administrative staffs, and teachers. For a computer programmer, computer literacy is different still. Since there are many meanings for computer literacy, the following is an attempt at an all-encompassing definition.

A computer is defined as an electronic machine which, by means of stored instructions and information, performs rapid, often complex calculations or compiles, correlates and selects data.

Literacy is defined as the state of being educated or possessing knowledge and experience. Introductory computer literacy implies a general knowledge of computers and what they do as compared to specific technical details of computers.

Hence, computer literacy is the state of being educated or possessing general, specific knowledge and experience in the operational behavior of an electronic machine that performs complex operations at a rapid pace with a high degree of accuracy One possessing computer literacy would be expected to have some knowledge of computer applications, costs, capability, limitations, hardware, and computer vocabulary.

For board members, computer literacy can be defined as:

- Whatever a person needs to know about and be able to do with computers in order to function competently in our society.
- The ability of an individual to deal effectively with computers in terms of knowledge, attitudes, skills.
- Whatever understanding, skills and attitudes one needs to function effectively within a given social role that directly or indirectly involves computers.

Computer literacy must be viewed as a continuum: from knowledge of what computers can do — to how to operate one — to being adept at programming. Each individual will want to have some degree of computer literacy but that degree differs depending on social, business, or personal needs. The citizens of a society where the computer is a dominant force must be computer literate in order to benefit collectively and individually from computer technology.

Before you as a board member can take the steps described in Chapter II, the answers to the following questions will help you achieve enough computer literacy to understand the concepts in the rest of the report and enable you to make the necessary decisions.

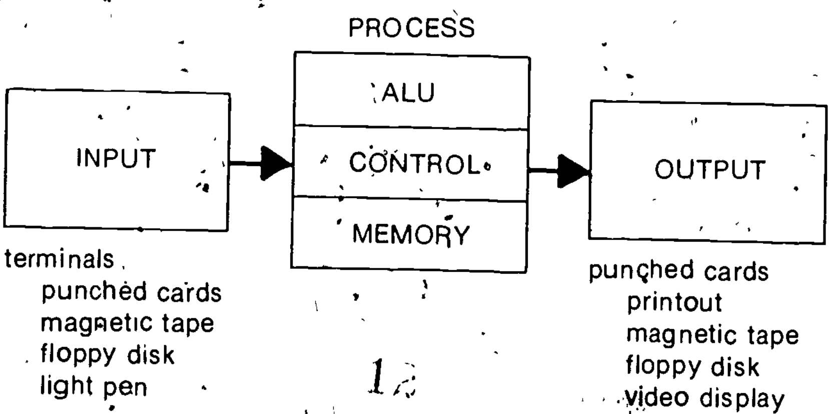
How Does A Computer Work? — The Basics

The basic building blocks for all computers are:

INPUT
PROCESS
OUTPUT

These building blocks make the computer very useful as a tool. They enable people and machine to communicate with each other (man/machine interface). They enable humans to instruct the machine and allow the machine to respond (programmability).

Computer Building Block Organization



Input

Input is the communication link between the user and the computer. It is the data that the computer processes User data may be stored on magnetic tape, punched cards, floppy disks and later retrieved or entered immediately via a computer terminal, the most common input device. A computer terminal is frequently called a CRT (cathode ray tube) terminal because it is a keyboard attached to a television-like screen — and a television is a cathode ray tube. Another common term is VDT or video display terminal.

Process

The process function is the focal point of any computer It is the means by which data is manipulated to achieve desired results. The key parts of the process function are memory, control and arithmetic logic unit (ALU).

A. *Memory*

Every computer has a main memory. In this memory is housed the program that instructs the computer, i.e. tells it what to do. The memory is organized in a certain order to allow for ease of programming. Memory is usually in disarray until personalized by a program.

The size and speed of the memory is very important when determining the type and size of computer to purchase Speed and size determine the computer's capacity for doing work. There is a direct correlation between memory size and speed and cost.

Auxiliary memory is available to expand the capability of the computer system to do work. This auxiliary memory comes in the form of magnetic tape, floppy disk, or disk drives. These devices allow for the storage of millions of bits of data to be used by the computer.

B. *Control*

The control portion of the process function establishes communications between main memory, input and output devices, and assists in the storing of data as directed by programs. Data written into specified locations in memory or read from specific locations in memory is retrieved with the appropriate controls required to access memory. To compare conditions upon which decisions are to be made as to the next program step requires controls. The control portion of the computer process may be compared to a traffic cop directing a very fast traffic lane at an extremely busy intersection with no accidents. The controls will assure success every time. They will do exactly what they are told and will do it at a very fast pace without error.

C. *ALU* (Arithmetic Logic Unit)

The ALU is the portion of the process that performs the arithmetic function. It performs such operations as addition, multiplication, division, shifting, moving, comparing of data within main memory and from auxiliary memory. This unit provides significant power to the computer. This is the key to the power of a computer. It also provides program flexibility.

Output

Output is processed data. It is in a format that can be readily interpreted by the user 'Output can be displayed in many ways. The computer printer is the most common means for output, but output can be put onto punched cards, magnetic tape, display terminal, or transferred to another system. The key purpose of output is the transformation of the results of processed data to a format that can be interpreted by the user. The type of output is determined by user preference Some common output devices are printers, card punch, magnetic tape, and display terminals.

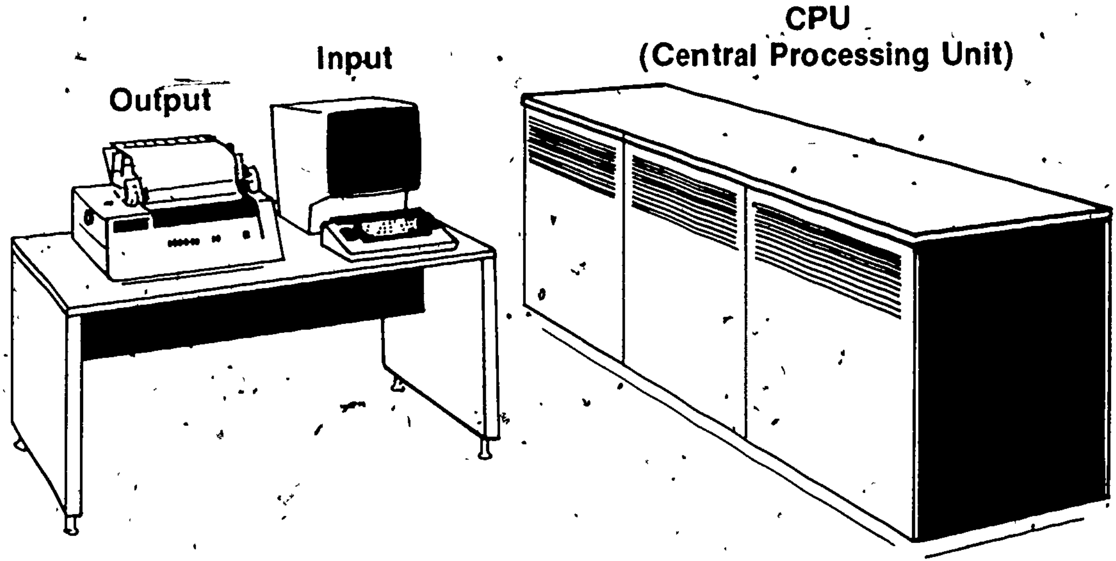
What Can A Computer Do?

In General

Much has been written extolling the power and capabilities of computers. Computers have touched the lives of most people in some way. Computers are part of the rapid technological growth in this country and the world. Computers are deemed necessary to maintain the edge in the economic sector. Computers are used in medicine, art, education, design, research, travel, government, military, space exploration, and many other areas that affect all of us and the computer will play an even bigger role in our lives.

Because of the significant impact computers are having on society, and will continue to have on society, it is imperative that education incorporate computer literacy in its curriculum starting in the elementary grades. This requires that board members, staffs, and teachers become literate in the use of computers, not in a technical sense but from a how to use sense. Simply stated, computers are needed in the education environment to educate staff, teachers, and students in the use of computers, a necessary skill for survival.

The next few pages focus on information the board will need in order to bring its schools into the computer age. Chapter IV is a more detailed technical explanation of computer operations.



Elements of A Computer System
(Minicomputer)

In A School District

Briefly, a computer has many functions in school districts, such as in:

Business
Payroll
Accounting
Fringe benefits
Budget modeling
Stores
Attendance

Personnel
Personnel records
Sick leave
Substitutes

Curriculum
Mathematics
Science
Language Arts
Library Science
Spelling

Computer Programming
Employees
Community
Children

Before any district purchases a computer system or adds onto its current system, it should first assess its needs to determine what is best for the district.

Business, Administrative and Personnel

In the business and personnel areas, it is extremely important to keep exact records and have them readily available. A computer with adequate storage can be an asset to districts. Many districts have received more ADA from the state as the result of better record-keeping using a computer. In fact, the additional money has assisted in paying for the system.

Curriculum

The curriculum area can and must be enhanced. The computer can be used as a tool by the teacher to do all of the record-keeping and drill for all subject areas. This will free the teacher to do more analytical work and less record-keeping. The students respond readily to computers. They will progress and will learn more in the process.

The computer can be used extremely effectively for remedial instruction, enrichment instruction, computer literacy, competency and proficiency.

There are three major ways to approach instruction with the use of computers.

a) Computer Assisted Instruction (CAI). Usually a dialogue between the student and a computer program, whereby a student is informed of his or her mistakes as they are made.

b) Computer Managed Instruction (CMI). Using the computer as a component of the subject matter curriculum, assists the teacher in determining students' progress.

c) Computer programming instruction Teaches a valuable skill that will be beneficial to students and the community as students progress through high school, college and into the job market Also used to train district employees to use the system

What Kinds of Systems Are Available?

The kinds of computer systems vary greatly. Systems range from large and complex systems to micros or home computers. Each system is designed for specific applications. Depending on a school district's assessed need, a system can be found tailored to those needs.

Criteria to be considered when deciding which size computer a district needs include. speed, memory, versatility, adaptability, cost effectiveness and software availability Vendors are able to assist in this area and provide information and specifications for each system they offer. Some typical systems are shown on pages 14 and 15.

What are the Limits and Capabilities of Computers?

Computers have the ability to process and store vast amounts of data (information) depending on the type of system They do *not*, however, have the ability to make value judgments, make decisions or think independently — at least, not yet. The computer is a type of calculator that can only handle quantitative data. Human input is required for the computer to operate.

Different systems have different capabilities Some are designed for highly complex functions (such as the space program) and others can sit on a desk top and perform very few functions. Criteria and priorities must be established for examining systems to best meet the district's needs. In some cases the speed at which a computer can process data may be most important. In others, reliability, and/or versatility may be the most important aspects.

It is very important to understand the limits and capabilities of any system, as it relates to specific applications, before a purchase is made. Many trade-offs can be made in the selection of a system, but the understanding of what limits have been traded off is equally important. What you agree to with the vendor is what you get.

Evolutionary In Nature

The first generation of computers filled huge rooms. Today, micro processors can perform the same complexity of functions with greater speed and sit on a desk top. The next five years will undoubtedly bring as many changes as the first twenty years altogether.

When considering a computer system, its adaptability and flexibility must be identified. A large expense such as a computer must be able to provide service to the district for a period of years. For instance, initially a district may be able to afford one or two terminals, but two years from now it may afford ten or twenty. Can the system accommodate an expansion? Does the vendor provide for future upgrading of the system?

System Obsolescence

One factor that must be taken into account in the selection of a system in system obsolescence. How long with the system serve the district? Can the system be upgraded to perform additional functions as new demands are made. New applications will invariably come as experience is gained on the system.

The chart on page 16 shows how to compare the price and capacity range for each system under consideration. The lower price is usually the entry level for the system. The higher price is the top range for the system This allows for system growth. These features are usually designed into the architecture of the system to allow for expansion If a system has no expansion capability, it should not be purchased initially Any initial system should have expansion features.

Who Can Help?

Before your district makes such a sizeable and complex investment, get whatever help you need.

Systems and applications change as rapidly as the technology, so someone who is knowledgeable about the latest developments is a must in order to realize optimum return on the investment.

As discussed in the next chapter, many districts appoint committees to examine the feasibility of a computer, help determine goals and objectives for the system and assist in evaluating the various alternatives available to meet the district's goals.

It is essential that the committee include as least one person knowledgeable about computers. If no such person is available in your district, consider hiring an outside consultant.

Consultants will have answers to many of the detailed questions and will help you determine what type of system and equipment will best meet your needs, looking at cost and capability.

Consultants are seldom inexpensive, but their input will pay off with system satisfaction. And assistance from a consultant will certainly pay off if his or her help has prevented costly errors.

How Can We Find an Outside Consultant?

The computer literature is one place to begin your search for a consultant. Other sources include any of several computer users' organizations, neighboring computer-using districts, or your county office.

Once a system is chosen, vendors can offer leads to districts on programmers and analysts who are familiar with their particular products.

How Can the District Get the Best System for Its Money?

In general, annual cost for data processing and instructional computer usage should constitute one to two percent of the district's gross budget.

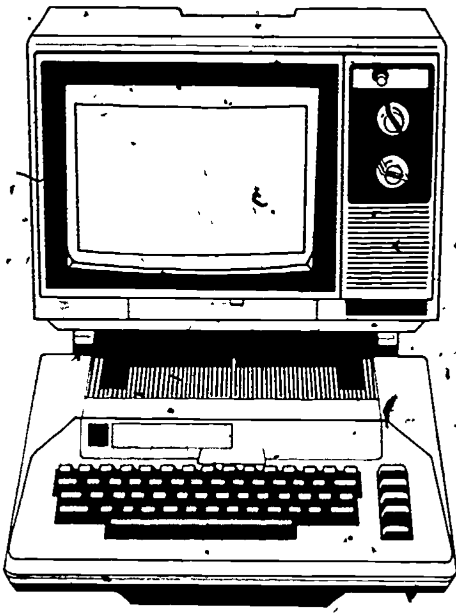
Options

Huntington Beach Union High School District (25,000 ADA) has one of the state's most extensive computer systems. Glenn H. Dysinger, HBUHSD's assistant superintendent for planning, research and negotiations, prepared the following summary of the district's resources and the money the district annually commits to them. Districts with smaller budget commitments can consider these elements as options; HBUHSD, however, has all of them.

- 1 percent to 1.5 percent of gross budget

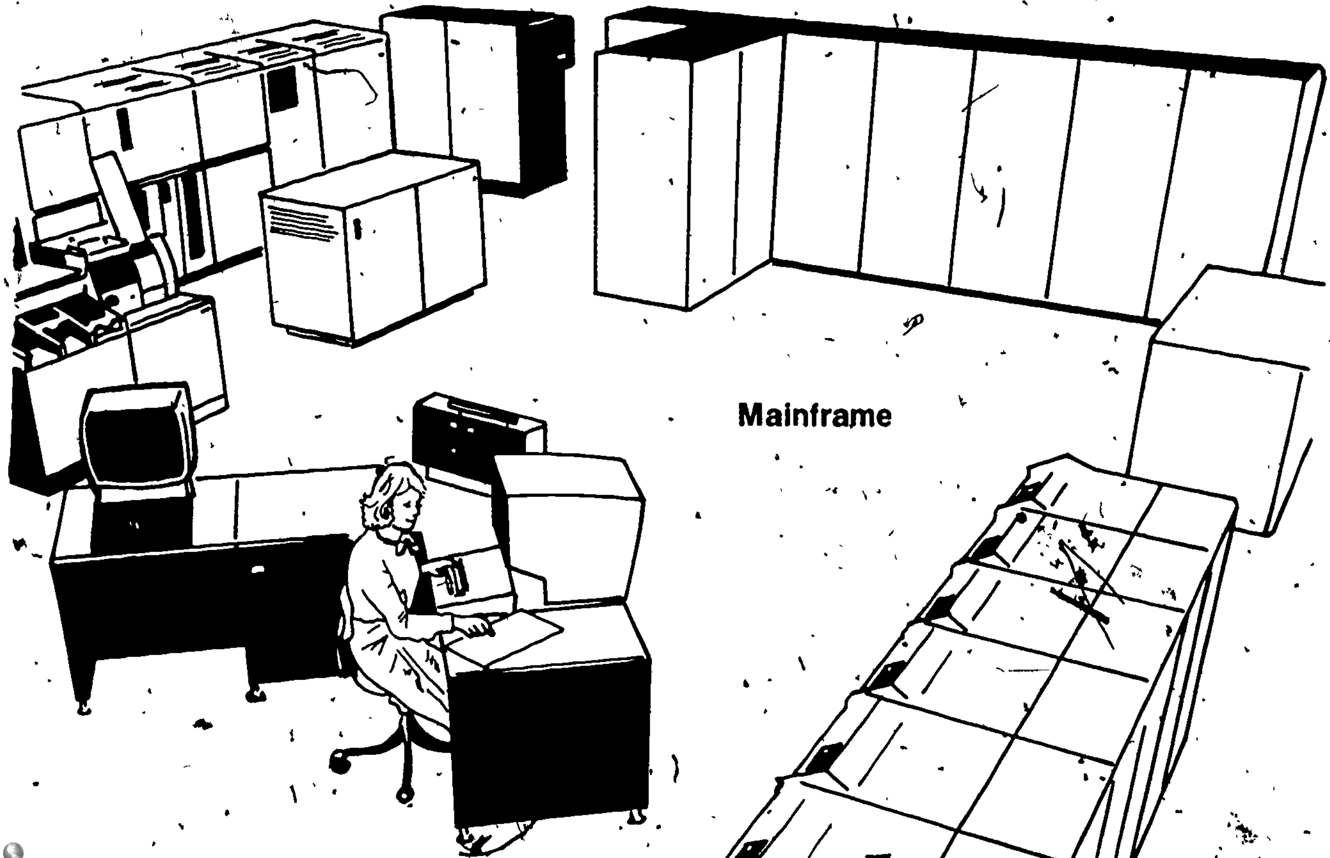
Hardware	**Annual Cost**
• Large system — batch — online — timeshare	$300,000+
• Minicomputer — batch — online — micros	$50,000+
• Microcomputer — standalone	$10,000+
Software	
• Program with own staff	$300,000+
• Buy tailored "turnkey" packages + stock software	$50,000+
• Stock software	$10,000+

Three Kinds of Systems: Micro, Mini, and Mainframe



Micro Computer

Mini Computer


Mainframe

Comparing Computer Systems

The table below illustrates how systems can be compared. The figures cited were accurate at a certain point in time. Although they are subject to change, these factors demonstrate a method board members can use to evaluate competing capabilities. One immediately apparent fact is that the larger a system's capacity and power, the greater the cost.

System Size	Large	Medium	Small	Micro
Capacity	16-32 MB	4-25 MB	1-8 MB	4.0-256 K
Speed	5 67-10.3 MIPS	.9-3.1 MIPS	.2-.8 MIPS	Slow
Initial Operating Cost	$3.7-4.1 M*	$1.0-3.0 M	$.85-578 K	$.499-5.0K
Number of Terminals	100-200	100-200	50-100	≈1
Disk Storage	2520-20,160MB	2520-10,080MB	64 5-5080MB	89-360K
Usage Batch	X	X	X	X
On Line	X	X	X	

*Basic cost includes the following components:
Main frame, Memory, Key board, 1 Display terminal

MIPS = Million instructions per second

MB = Megabyte K = Thousand

In evaluating the relative costs of computer systems, the cost of the initial pieces of hardware (the computer) is only one item to examine.

Evaluating an entire system includes examining the relationship between the initial costs versus the ability and cost of the remaining elements of the system which will fulfill your district's long- and short-range needs.

Among the items to be considered and costed are storage, software, reliability, availability and serviceability.

Storage

Storage costs are a consideration when purchasing a computer. It is important to examine not only the storage capabilities that the system itself provides, but also to examine the potential for auxiliary storage.

The following worktable may help you when considering storage costs:

Cost Comparison for Auxiliary Memory

Kind of system	Mode of storage	Amount of storage	Cost/Memory
Large	disk drive	1 MB = 1000K	5¢/100K
Micro	floppy disk	.1 MB = 100K	5¢/1K

The figures cited above were accurate at a certain point in time. Although they are subject to change, these factors demonstrate a method board members can use to evaluate competing capabilities.

Software

A system does not run by itself. It must be told what to do and how to do it, in other words, programmed. This general series of instructions is called software To run, a system requires the software to tell it what to do. Software can be purchased as a package or developed by in-house programmers. But whatever the method, software costs are inherent in any operating system.

Should a district decide to develop in-house programs, then the district must face the cost of programming. Should a programmer be l or should current employees be trained to be programmers?

This is a problem both ways. An experienced programmer's salary is much higher than what most district employees earn — and programmers are in great demand. On the other hand, the district employee may leave the district after receiving programming experience.

Maintenance

Maintenance is another cost item. Should the district attempt to maintain the computer in-house or service it outside? It is imperative that anyone working on computers understand the complex nature of the system. It is not easy to fix. It is complex in nature To be sure of getting the best results, outside service should always be employed

Serviceability

When purchasing a system, serviceability is one of the key requirements of the system. It must have high reliability to lessen the frequency of servicing. Projected serviceability data can be provided by the vendor at the time that the system is proposed.

Look at system availability during servicing. See if the total system is lost or minimal processing can continue while the system is being serviced. Any loss of computer time is a cost to the district. Make sure that projected servicing data is in the contract and the terms are explicit. Don't take any short cuts.

Cost Saving Potential

The application of computers to many of the district's business and administrative tasks can save the district money.

It can also increase district revenue.

For example, many manual operations such as attendance, ADA calculations, student achievement (progress reports), budget preparations, personnel accounting and other manual operations can be computerized. Whether the particular application will result in a savings is determined by comparing the time it will take to do it manually versus the time it will take a computer to perform the same tasks. The hours saved can be costed and the differences determined. This allows comparisons before a computer is purchased, and it allows a solid base upon which a decision can be made. See example on the next page.

With today's tight school budgets, computers can often be a boon to the district by bringing in additional revenue — even if the computer's application to school curriculum is your primary reason for wanting to acquire the system. While there are no direct cost savings in the instructional application, the cost savings in these other areas are a benefit the district should take into consideration en making decisions about computers.

Manual versus Computer System Comparison

EXAMPLE: ATTENDANCE AND GRADE REPORTING (250K STUDENTS)

MANUAL	COMPUTER SYSTEM
3780 HRS.	1205 HRS.

In this example, the computer can do the work in one-third the time required to do it manually. The manual hours represent people (salary, fringe benefits). Therefore, manpower costs can be reduced while still getting the work done. In addition to the manpower reductions, the following benefits can also be realized.

- Reduction in teacher time required for record keeping
- Increased instruction time.
- Central location of readily available data.

For instance, records of student attendance are extremely important for most districts, for upon this ADA rests the money to operate. Manual operations are fraught with errors because of the many manual transpositions It is just human nature And errors can mean lost revenue An automated system can do the job accurately and consistently every time Accuracy can translate to more dollars to the district One district justified the purchase of a computer system by the projected increase in district revenue by improved attendance records

As a side benefit, teachers can get updated attendance for each class and can readily tell who is cutting class or is absent This reduces the number who miss or cut class, hence attendance improves

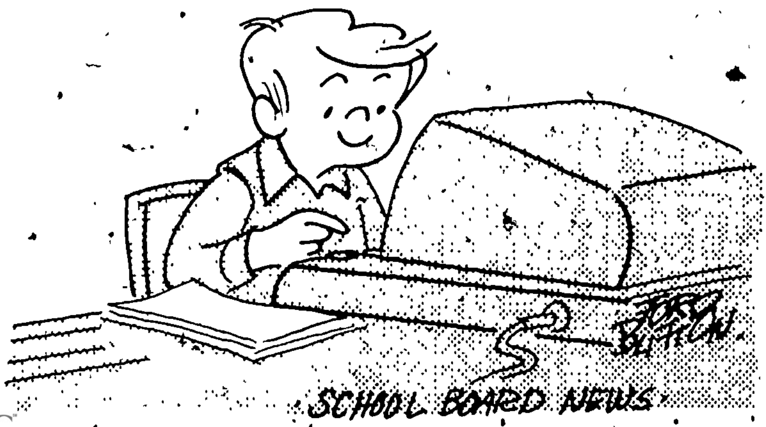
Each district must assess its requirements and determine what savings a computer can provide Not all districts will realize the same savings, but such evaluations can best determine where savings can be realized

Summary

Board members must become literate in computers and they must [illegible] the initiative There must be the desire to understand how computers work and how they can be employed in education Once computer literacy has been achieved, boards must exploit this technology to better perform the tasks of educating our children. Education must be meaningful and relevant to the technological opportunities generated by computers.

The introduction of the micro-computer has made the computer more viable as a classroom tool Larger systems can be employed in the personnel, accounting, payroll areas Each district must assess how a computer system will be of benefit Resources must be provided to purchase the desired computer system To be successful, there must be a total commitment on the part of board members, staffs, and teachers.

The next chapters focus on the information a school board will need in evaluating computer curricula, examples of how other districts have done it and a more extensive explanation of how computers work



"The losers in the transition to an information-service society will be those who persist in believing that the future will be similar to the past."

Michael Annison, director, Rocky Mountain Trend Report (1982)

Chapter II
Computers in the Curriculum

Feasibility of a Computer Curriculum

A computer curriculum is not only feasible, it is essential in today's increasingly technological society. Computer literacy is now as necessary to a student's educational program as such basics as math, English and the sciences. To meet this new need, each school district must consider certain basic components to the feasibility of a computer curriculum.

How practical is it for a school district to achieve such a necessary addition to its curriculum?

Can a computer curriculum be developed to achieve computer literacy, and can it be developed within a reasonable and practical time frame?

Can it be carried through to a successful conclusion?

Simply stated, is it feasible?

The answer is yes! There are, in fact, existing computer curricula already in use and others in various stages of development by many school districts throughout California as well as other states. Earlier curricula often were designed to meet specific programming needs rather than to achieve overall computer literacy. What is needed now is the expansion of these existing computer curricula to meet present and future computer needs. The basic fact remains: Computer literacy *is* a mandatory addition to the curriculum, not just as a future option but as a necessity for *today's* students.

In order for computer literacy to achieve its rightful place as a curricular option, the governing board must make a strong commitment to it. The basis for this commitment must come from the board's knowledge and acceptance of two factors: first, that today's students are growing up in an increasingly technological society and second, that it is the board's responsibility to educate and prepare them to live and work in such an environment. The board's commitment is realized when it is willing to allocate the necessary resources (time, money, staff) to achieve a computer curriculum.

Looking Ahead: A Coordinated Approach

The board must have a vision of the future needs of the community and society, and plan how the current educational program can best meet them. A proactive rather than reactive approach is mandatory when considering students' needs to function in tomorrow's advanced technological environment and it is evident that computers will play a significant role in their future. Many board members have positions in industries that look to the future and they can provide valuable insights into what future educational needs will be.

Not only must the board be willing to commit to the financial support of an adequate computer program but it must also be directly involved in setting priorities of the functions of the equipment.

With appropriate funding, the overall plan will include periodic additions to the data base and the use of the equipment — all of which should be in consonance with the board's priorities.

A coordinated approach will then result, over a period of time, in

Computers Can Improve Test Scores

The following data from the Education Testing Service demonstrate that computer assisted instruction (CAI) improves mathematics scores and that long-term (three years) computer use results in continuing gains in educational performance. Marjorie Ragosta, Paul W. Holland and Dean T. Jamison conducted the study with Los Angeles USD under a grant from the National Institute of Education to the Educational Testing Service. CST is an abbreviation for the curriculum-specific test, a test based upon the CAI curriculum.

Table 1

Mean Treatment Effects in Standard Deviations for Students Receiving CAI in Mathematics

	CST	Standardized Test			
		Computation	Concepts		Applications
Duration	Grades 1-6	Grades 1-6	1-2	Grades 3-6	Grades 3-6
1 year(12 studies) ..	.80	36	.34	- 02	.03
2 years(6 studies) ..	.91	.56	.50	.12	.12
3 years(3 studies) ..	1.23	.72	—	.09	26

computer programs as you envisioned them when you initially committed to them.

As elected officials, board members must assess local attitudes of their community and take them into consideration when making decisions In many communities there is already a high degree of awareness concerning the computer's present and future impact and, therefore, an understanding of the necessity of making today's students computer literate Other communities may not collectively realize the computer's growing importance in today's society. In those cases, it is the board's responsibility to assume the leadership role in educating the community and in encouraging its support for computer literacy.

It is important to note that ours is a highly mobile society Not only

Table 2
Mean Treatment Effects in Standard Deviations for Students Receiving CAI in Reading

	CST	Standardized Test	
		Vocabulary	Comprehension
Duration	Grades 4-6	Grades 4-6	Grades 4-6
1 year(7 studies) ...	.44	25	23
2 years(3 studies) ..	52	.17	-.01
3 years(1 study)....	.42	.58	- 24

Table 3
Mean Treatment Effects In Standard Deviations for Students Receiving CAI in Language Arts

	CST	Standardized Test		
		Spelling	Mechanics	Expression
Duration	Grades 3-6	Grades 3-6	Grades 3-6	Grades 3-6
1 year(9 studies) ...	70	.14	.23	10
2 years(4 studies) ..	76	05	.27	.05
3 years(2 studies) ..	.73	14	25	.23

do populations shift, but rural areas of today may become technological centers in the near future. In order to prepare their students with the necessary technical skills to compete for future jobs, all school districts should attempt to offer computer curriculum to the greatest extent possible.

The community's makeup and attitudes have a significant impact on how available resources and personnel can be applied in the educational process. It will require more effort in those communities not directly affected by technological growth but, in any case, it is the duty of the board to convince and lead the community in its desire to achieve computer literacy for its students.

In order for the computer literacy program to move forward, it is essential that the board of trustees and its administrative team have a strong foundation of computer knowledge themselves. The board must comprehend general computer concepts, and at least some of the members of the top management staff must be conversant about the advantages and disadvantages of various sizes and types of computer configurations and the appropriateness of, for example, micros versus large mainframe computers.

The implementation of a computer curriculum can be achieved by board directive, but a successful program requires staff involvement from the start. While staff members are the implementors of the board's goals and take their direction and guidance concerning the educational program from the board, the cooperation, enthusiasm and support of the staff make the difference between a mediocre program and one of excellence. Staff must also be aware of, and understand its obligation to prepare and educate students for a future in a high technology society. The ideas, recommendations and suggestions of the staff must be a part of any board's commitment to a computer curriculum.

Many staff members are already cognizant of the growing importance of computers in education and have taken it upon themselves to become literate to some degree. They are anxious to provide input from their own experiences and are waiting to be tapped.

The staff must be supportive and understand the advantages of the use of Electronic Data Processing (EDP) equipment and systems to solve the district's day-to-day problems. This support should be sought through inservice and employment questions so that both certificated and classified personnel new to the district have either a background in this vital area, or are forewarned that this information [illegible] important to the district.

The Long-Range Plan

It is mandatory that a detailed plan be developed to achieve a successful computer curriculum. This plan must identify resources, commitment, steps for implementation, time lines and other needs. It must also identify any weaknesses in the overall effort. It must answer the WHO, WHAT, WHEN, WHERE, HOW and WHY questions in as great a detail as possible. The success of any computer curriculum will depend upon the quality of the overall planning at the onset.

Specific questions concerning the computer curriculum itself must be considered during planning. What does the district want to accomplish through a computer curriculum? How does it want to design and implement the computer curriculum in order for it to be applicable today and in the future?

Those planning the computer curriculum must possess the ability to look beyond current needs and assess the future potential of equipment and software currently available and under consideration. However, the integration of five-year goals must be achieved without ignoring or catastrophically delaying short-range needs.

Board members must commit themselves to becoming knowledgeable at the very least to the extent that they can ask the right questions to either hire or train a person to manage computer resources. While board members need not acquire detailed computer knowledge, there should be at least one person available to the board who understands computer systems, district business, educational applications and climate in order to achieve optimum benefit. This data processing (dp) person should have an understanding of the district's overall plan so as to use and manage all available resources effectively and wisely.

Competent personnel already in the district should not be overlooked. Many districts already have computers for business purposes that could also be managed to allow the addition of computer curriculum applications. If there is a data processing manager currently on staff, such a person already has the needed expertise. If no such person is available, the district or consortium of districts must hire a competent, qualified "dp manager." The dp manager is the district's computer expert and should be considered and used as a major resource from the planning through the implementation stages of the district's computer curriculum.

To keep planning headed in the right direction, the board must emphasize a coordinated approach as opposed to a laissez-faire approach. That is, know what it is the district wants to accomplish and how, rather than be diverted from the long-range plan by short-m expendiencies. Together, board and staff must systematically plan the implementation of computers into the curriculum.

Fitting the Computer to the Plan

Planning for appropriate installations, expansion and standardization of components (hardware and software) must employ staff expertise or outside consultants. For instance, understanding the importance of an economically-stored data base is essential, since gradual growth with small, over-priced storage devices can easily lead to runaway costs.

If the district has already acquired some elements of a computer system, the plan should consider if the current equipment will allow your district to achieve its goals, whether it has the capability to expand to eventually achieve those goals, whether the appropriate software to achieve the goals is available for *that* system, and whether it is more cost-effective to expand the present system or start over.

Because these considerations are the same whether the district is making its initial purchase or expanding its current computer capabilities, the following tips on how to fit the system to the district's plan apply to both situations.

A prerequisite of any system or equipment order through bid specifications should be the availability of suitable programs (software). The board should always require demonstrations of the programs of interest on the equipment being considered. Actual demonstrations are a standard practice in industry and should not impose a burden on prospective vendors.

Many educational programs are available, so a district must determine which software best meets its requirements based upon applicability, quality and effectiveness. An initial step is for the district to clearly identify, in each phase of the curriculum, its expectations of and specifications for the software. From that point, hardware and software vendors, private consultants (programmers) and computer organizations* should be explored regarding available options.

Several districts have their own programmers. This is ideal for curriculum development, as it enables the district to meet the needs of the students in a very effective manner. Another benefit is that of

---

*Computer education organizations:
MECC — Minnesota Educational Computing Consortium
NWREL — Northwest Regional Educational Laboratory — Microsift
CUE — Computer Using Educators

continued evaluation and modification to enhance the computer curriculum, as the need arises.

Currently, there is a universal shortage of qualified programmers This can be a severe problem for school districts when recruiting, but

Avoidable Pitfalls

- The greatest mistake educators can make is trying to do everything at once rather than plan a piece at a time. The common error is not recognizing the time and effort required to implement a program after it has been designed. With a properly prepared plan that adequately describes the objective before work has begun and commitments have been made, the system will proceed step-by-step towards that objective. Take it a step at a time and enjoy the steps.
- A computer cannot be a panacea. Don't fall into the trap of believing that a machine can solve all the district's problems. Certain computers can meet certain needs, but cannot solve everything. Goals and objectives must be determined so the school district can *best* match its needs to the appropriate system.
- Avoid gadgetry. Usually gadget computers or enhancements are short-lived and over the long haul can never provide a significant cost savings to a district.
- Experimentation can prove costly, as well. Look to the system that can give you the best long-term results after determining what the long-term goal is.
- In summary, the following factors enter into the decision on a computer system that will not disappoint you:
  - — Does it meet your needs (as determined by a needs assessment)
  - — Competitive price
  - — Can it be upgraded for advances in technology?
  - — Versatility of applications
  - — Software availability
  - — Good service record
  - — Fragmentation (costs of hardware, software, maintenance and staff development can be higher if different brands are used instead of an integrated system).

the ability to attract highly qualified applicants can be enhanced by two factors. First, the relative security offered by a public entity and second, the current downturn in the national economy.

Other school districts already using programs that have been developed in-house should be considered as a valuable resource. Such districts would be pleased to share their knowledge and expertise and perhaps even provide copies of their programs.

With the recent expansion of the home computer market, more and more commercial curriculum programs have been developed. The simplification of these small home computer systems has increased demand and makes it easier to develop programs. Many of the major educational textbook publishing companies are expanding into the computer curriculum business. There are "canned" programs for specific applications that cannot be modified once they have been purchased, unless an agreement is first reached with the programs's publisher. It is imperative that a thorough search of the market for what is most applicable be conducted before a program is decided upon.

Financing Options

The type of computer curriculum the board decides upon may vary depending on the size and location of the school district. The board of a rural school district may feel the emphasis (and budget) should be placed on Computer Aided Instruction (CAI) rather than on teaching any actual student-hands-on computer programming. On the other hand, the board of a large urban school district may wish to offer the opportunity for its students to learn several computer programming languages as a type of vocational training.

Although the size of the district may place restrictions on available resources, the use of the computer in curriculum must still be addressed.

Small districts must explore available options, such as joining with other small districts and pooling their resources to provide an adequate computer curriculum for all. Options such as this cannot be ignored as they may be the only way to proceed in these days of declining enrollment and increasing financial constraints. Because a district is small does not mean that it cannot or should not have a computer curriculum.

Financial resources are strained in any school district today. Not only is there little money for developing a computer curriculum, there is little money to maintain present programs.

This dilemma must be approached as an opportunity to be tive in the managing of district resources.

Some districts have justified their computer systems on the basis of costs savings due to better attendance accounting There are other ways to justify computer systems, but the most important consideration is the necessity to educate children to be able to function and thrive in an increasingly technological environment The fact that this important need may be difficult to justify should not deter board members. Ways must be found to provide the necessary resources to implement an adequate computer curriuclum in each and every school district in the state of California.

A study of the financial impact of implementing a computer curriculum must occur during the planning stage. The first step is an analysis of the budget and a special study of present data processing expenditures with an eye for reallocating monies to provide greater flexibility. Some districts set aside a percentage of their gross budget for data processing and computer education.

With a commitment of one to two percent of the gross budget per year, a district can expect to have a state-of-the-art computer system, including hardware, software and maintenance, which will provide broad instructional capability, word processing, administrative and business functions.

Of course, the varying sizes of district gross budgets would mean different computer systems and personnel to maintain them. However, within the last decade the industry has fairly well established this figure (one to two percent) as a reasonable estimation of appropriate EDP expenditures.

Available funds for education will be limited in the near future and, therefore, it is crucial that boards of trustees establish five-year capability plans for their computer literacy programs. This not only makes five-year utilization possible, it also may allow boards to tap the interest-free money that is still available from some banks for such projects. Such plans also aid the board in avoiding the trap of short-term leasing which has the effect of making initial entry painless, yet requires inordinate amounts of ongoing budget support for the maintenance and lease payment of equipment.

In other words, with sound five-year planning, purchase acquisition of equipment is the most viable route and should be utilized whenever possible with online systems. The need for additional personnel should be minimal, although daily maintenance of programs and batch operation may require some additional employees. As a guideline, if the district has a budget in excess of $15,000,000 gross, then full-time programming personnel can be added within the 1-2 percent guideline.

Alternative ways of funding must be explored and developed. As an example, if neighboring districts share a common goal — to provide computers as part of the curriculum — a consortium of computer-using districts may be able to provide a wider range of computer curricular options through pooling their financial resources. This consortium concept may be the most feasible approach in these times of financial restraints.

Gifts from community organizations, individuals and local industry are another option which should be explored. Although it may not be possible to subsidize the entire program in this manner, a substantial portion may be underwritten.

Another possibility would be grants from foundations, industry, and government. Grants from such organizations as the National Science Foundation have provided a beginning for numerous computer curriculum programs. With the decline of state and federal dollars, grants are limited, but should be explored.

Business tax incentives for computer donations to schools have recently been enacted at both the federal and state levels and more are contemplated.

Even before these changes in the tax laws, many computer firms and large manufacturing industries have been willing to donate equipment and/or staff expertise to benefit local school districts. However, in order to capitalize on some awards, the district must be careful to maintain its planning so that obsolete or inappropriate donated equipment will not prove to be a burden to the district.

Because your planning includes specifications on appropriate equipment, care should be taken before accepting donations. Donations requested within this framework should not allow for piecemeal donations from multiple vendors which might tend to delute the district's central computer plan and resources.

Educational computer usage does not lend itself to a cost savings. However, we do not justify math, English, and science in terms of cost savings and neither should we have to do so for computer education. It is just as necessary in the 1980's as English. Computers must be integrated into the curriculum in order for our schools to provide a relevant, significant and total educational program to their students.

Evaluation of Curriculum Programs

In all the computer curriculum programs the task force reviewed, there were no guidelines developed for board evaluation. Most of the programs started at the grassroots level and then to the board, rather than from the board down. Usually if the money is not from the ·ral fund, no evaluation guidelines are required. Therefore, the guidelines presented here are those determined by the task force to be essential for a board to evaluate computer curriculum programs.

Needs: Prior to the development of any computer curriculum a detailed needs assessment must be done. The assessment must include staff, teachers, students and community.

Goals and Objectives: Each computer curriculum program must have clearly stated and measurable goals and objectives and address a specific level of computer literacy.

Measurement: The effectiveness of each curriculum must be measurable. Instruments that can be used to measure student achievement are CTBS, CAP, standardized tests, weekly evaluations, visitations, demonstrations.

Evaluation: There must be a curriculum evaluation program to determine program adequacy and applicability. This allows the tailoring of programs prior to implementation.

Flexibility: Curriculum must be flexible. Can it be expanded easily? Single applications must be discouraged.

Adaptability: Curriculum must be adaptable to existing systems.

Programmability: Curriculum must be easily programmable to allow for updating to improve instructions.

Policy: Board should establish a curriculum policy to evaluate computer curriculum.

Computer Literacy Committee: Establish a committee to review computer curriculum offerings.

The key to any evaluation is a procedure that will allow for measuring of desired outcome. Outcome must be established at the time of implementation. The board must be involved in the beginning such as to have some knowledge of how the curriculum will be started and maintained. One of the other advantages of having the board involved at the start is directions from the top.

Summary

In summary, a computer curriculum is feasible. It is achieveable and can be carried through to a successful conclusion, but the necessary ingredients described in this chapter are essential.

Are Using Computers

***"Listen up and listen good . . .
"I like these computers because they help you learn new things, they . . . help you in lots of ways."***

— elementary school student

Chapter III
How Other Districts Are Using Computers

The Computer Literacy Task Force was charged with finding examples of outstanding computer curriculum programs by surveying existing programs.

To fulfill this charge, districts throughout California were asked to share their computer curricula with the task force. Contact was made with agencies outside of the state also. Responses were good.

Appendix C on page 75 summarizes the responses.

Material from Minnesota Educational Computing Consortium (MECC) was judged to be outstanding.

The following MECC criteria were used to identify outstanding computer curricula:

1. Applications: Does the curriculum address the applications of computers to the social and technological areas of society?
2. Hardware: Is basic computer vocabulary addressed?
3. Components: Are basic computer components discussed?
4. Programming/Algorithms: Are details of computer programming covered?
5. Limitations: Are the limitations of a computer detailed?
6. Usages: How are computers used?
7. Software: Is software addressed? How does software relate to hardware?
8. Impact: Does the curriculum address the impact of computers on society?
9. Implementation: Has curriculum been implemented? How long has curriculum been in effect?
10. Coverage: Does curriculum cover all grade levels?
11. Expandable: Is curriculum expandable? Is it integrateable?

Each curriculum possessing a majority of the criteria was considered as outstanding.

The review of submitted computer curricula revealed several outstanding programs. In order to keep this report to manageable size, only one exemplary program is outlined in detail: that of the Cupertino Union School District.

Other exemplary programs summarized briefly in this section are those from:

Albany School District
Emery Unified School District
Fresno Unified School District
Mother Lode School District
Redwood City School District
San Anselmo School District
Prescott Unified School District No. 1 (Arizona)

The Cupertino USD program is reproduced here, by permission, as a resource for board members who are considering the use of a computer as well as for board members who are comparing existing programs.

CUPERTINO

Reprinted by permission, *The Computing Teacher*, September, 1981, and the Cupertino Union School District, 10301 Vista Drive, Cupertino, CA 95014.

The Cupertino Union School District (K-8) has an average daily attendance of 13,000 pupils. Although the district is in the heart of Silicon Valley, developing and implementing a computer literacy (awareness) curriculum has taken several years. As Bobby Goodson, District Computer Resource Specialist, says:

> "The success of a program like this, introduced throughout a district, is dependent upon a well-developed inservice program with wide participation that gives teachers a good foundation to build upon. We have reached this point because we have taken time (over three years) and worked in stages. I think a district would have difficulty instituting such a program as a complete package. People need to be trained and ready with an explicit curriculum in hand if the program is to be truly successful."

District personnel and parent volunteers began working with microcomputers in 1977. Financial support came from donations, small amounts from existing budget accounts in schools, and title monies (U.S. government funds for special purposes such as programs for the gifted or handicapped).

In 1981, the school board allocated capital expenditure funds to permit widespread piloting of the computer curriculum during the

1981-1982 school year. Two junior high schools started the year with 12 microcomputers with dual floppy disk drives and one printer. Two microcomputers were on a cart along with a 25-inch color monitor. Each elementary school that applied and was selected received five microcomputers, one of which is on a cart with a 25-inch monitor. Implementation dates were staggered so staff could finish sufficient training and have adequate support as the program began. Most schools housed the microcomputers in their media centers, but one uses them in a Specific Skills Learning Center.

COMPUTER LITERACY CURRICULUM

PHILOSOPHY & GOALS OF CUSD

All students will have an opportunity to become familiar with the operation of a microcomputer. They will become aware of the widespread use of computers in the world around them. They will be aware of both the computer's capabilities and limitations.

IMPLEMENTATION OF THE COMPUTER CURRICULUM

In grades 3-6, the use of a microcomputer will be part of the normal school activities. It will be available for use in the classroom as part of the regular curriculum and by students for individual use. Most computer curriculum objectives at this level can be met by routine classroom use.

In grades 7-8, a specific course in Computer Awareness and Introductory Programming will give students some of the knowledge needed to make wise educational choices in high school and eventual career choices. The computer curriculum objectives can be met in such a course and/or with the inclusion of computer related topics in math, social studies and science classes.

This curriculum, a guide to the ideas students should have an opportunity to learn about computers, was prepared with the help of many people. Without the support of the Board, administrative staff, teaching staff, and interested members of our community, this curriculum would not be possible.

The principal writer was Bobby Goodson, with the assistance of Jenny Better, Judy Chamberlin, Ron La Mar, Barbara Mumma, Jerry Prizant, Richard Pugh and Cheryl Turner.

Symbols used indicate the level at which given objectives and activities are introduced (I) and reviewed or reinforced (R).

IN SOCIAL STUDIES, STUDENTS WILL:

	K-3	4-6	7-8
1. Become familiar with a computer.			
101 — Become familiar with a microcomputer through its use in the classroom.	I	R	R
102 — Use a prepared program in a microcomputer.		I	R
103 — Describe the historical development of computing devices.		I	R
104 — Tell about the history of Silicon Valley.			I
2. Describe how computers affect our lives.			
201 — Explain ways computers affect our lives.		I	R
202 — List several ways that computers are used in everyday life.	I	R	R
203 — Identify ways that computers are used to help consumers.		I	R
204 — Illustrate the importance of the computer in modern science and industry.		I	R
205 — Identify career fields related to computer development and use.		I	R
206 — State the value of computer skills for future employment.			I
207 — Define the term "data base."			I

Objective	K-3	4-6	7-8
208 — Describe some advantages and disadvantages of a data base of personal information.			I
209 — Describe problems related to the "invasion of privacy."			I
210 — Describe ways in which computers are used to commit a wide variety of crimes and how these crimes are detected.			I
3. Describe how computers are used by social scientists.			
301 — Describe how computers are used by sociologists and other scientists.			I
302 — Describe how computer simulations are used in problem solving situations.		I	R
303 — Identify ways in which computers help make decisions.			I
304 — Explain how computer graphics are used in engineering, science, art, etc.			I
305 — Explain how computers are used as devices for gathering and processing data.			I
306 — List several sampling techniques and statistical methods used in the social sciences.			I
307 — Describe computer applications such as those consisting of information storage and retrieval, process control, aids to decision making, computation and data processing, simulation and modeling.			I

IN LANGUAGE ARTS, STUDENTS WILL:

	K-3	4-6	7-8
4. Define and spell basic computer terms.			
401 — Define (and spell) basic computer terms.	I	R	R
5. Tell about a person or an event that influenced the historical development of computing devices.			
501 — Tell about a person or an event that influenced the historical development of computing devices.		I	R
6. Describe how computers are used in information and language related careers.			
601 — Explain the meaning of "word-processing."			I
602 — Use a computer as a word-processor.			I
603 — Describe some of the ways computers are used in the information and language related careers.			I

IN SCIENCE, STUDENTS WILL:

	K-3	4-6	7-8
7. Define "computer" and "program."			
701 — Tell what a computer is and how it works.	I	R	R

	K-3	4-6	7-8
702 — Describe the historical development of computing devices as related to other scientific devices.		I	R
703 — Know the characteristics of each generation of computers		I	R
704 — Differentiate among computers, calculators and electronic games.		I	R
705 — Differentiate between analog and digital devices.			I
706 — Differentiate among micro-, mini-, and main frame computers and identify the five major components of any computer.		I	R
707 — Define (and spell) basic computer terms.	I	R	R
708 — Define software and hardware and list two examples of each.		I	R
709 — Define "computer program."		I	R
710 — Explain why a computer needs a program to operate.		I	R
711 — Define "input" and "output" and give an example of each.		I	R
712 — Recognize the relationship of a program, or input, to the result, or output.		I	R
713 — Explain the basic operation of a computer system in terms of the input of data or information, the processing of data or information, and the output of data or information.			I
714 — Evaluate output for reasonableness in terms of the problem to be solved and the given input.		I	R

	K-3	4-6	7-8
715 — Recognize the need for data to be organized to be useful.			I
716 — Describe how computers process data (searching, sorting, deleting, updating, summarizing, moving, etc.).			I
717 — State what will happen if instructions are not properly stated in the precise language for that computer.		I	R
718 — List at least three computer languages and identify the purposes for which each is used.			I
719 — State that BASIC is one of the languages used most commonly by microcomputers.		I	R
720 — Explain the existence of several variations in BASIC.		I	R
8. Explain how computers are used by scientists.			
801 — Describe the computer's place in our growing understanding of science.			I
802 — Show how a scientist would use a computer.			I
803 — Explain how computers are used in predicting, interpreting and evaluating data.			I
804 — Show that computers are best suited to tasks that require speed, accuracy and repeated operations.			I
805 — Describe situations which limit computer use (cost, availability of software and storage capacity).			I

Objective	K-3	4-6	7-8
806 — Identify common tasks which are NOT suited to computer solution.	I	R	R
807 — Explain how computer models are used in testing and evaluating hypotheses.			I

9. Use a computer to accomplish a simple task.

Objective	K-3	4-6	7-8
901 — List several fundamental BASIC statements and commands.		I	R
902 — Differentiate between random computer commands and computer programs.		I	R
903 — State the difference between system commands and program statements.			I
904 — Use a prepared program in a microcomputer.		I	R
905 — Create a simple program in BASIC.		I	R

IN MATHEMATICS, STUDENTS WILL:

10. Explain that the design and operation of a computer is based on standard logic patterns.

Objective	K-3	4-6	7-8
1001 — Explain that a computer design is based on standard logic patterns.			I
1002 — State the meaning of "algorithm."			I
1003 — Explain what is being accomplished by a given algorithm.			I

Objective	K-3	4-6	7-8
1004 — Follow and give correct output for a given algorithm.			I
1005 — Describe the standard flow chart symbols.		I	R
11. Demonstrate how a computer could be used to accomplish logical or arithmetic tasks.			
1101 — Read and explain a flow chart.		I	R
1102 — Draw a flow chart to represent a solution to a proposed problem.		I	R
1103 — Order specific steps in the solution of a problem.		I	R
1104 — Translate mathematical relations and functions into a computer program.			I
1105 — Use the computer to accomplish a mathematical task.		I	R
1106 — Evaluate output for reasonableness in terms of the problem to be solved and the given input.		I	R
1107 — State that data must be organized to be useful.			I
1108 — Describe the techniques computers use to process data such as searching, sorting, deleting, updating, summarizing, moving.			I
1109 — List several ways computers are used to process statistical data.			I
1110 — Explain the statement: "Computer mistakes" are mistakes made by people.			I

Integrated Approach

If these activities are combined into a single Junior High Computer Literacy elective, they could be regrouped with the following objectives:

THE STUDENT WILL:

Objective	K-3	4-6	7-8
A. Develop a vocabulary of common computer terms.			
401 (707) — Define (and spell) basic computer terms.	I	R	R
705 — Differentiate between analog and digital devices.			I
701 — Tell what a computer is and how it works.	I	R	R
704 — Differentiate among computers, calculators and electronic games.		I	R
706 — Differentiate among micro-, mini-, and main frame computers and identify the five major components of any computer.		I	R
708 — Define software and hardware and list two examples of each.		I	R
711 — Define "input" and "output" and give an example of each.		I	R
207 — Define the term "data base."			I
B. Be familiar with the history of computing devices and the development of computers.			
103 — Describe the historical development of computing devices.		I	R

Objective	K-3	4-6	7-8
702 — Describe the historical development of computing devices as related to other scientific devices.		I	R
501 — Tell about a person or an event that influenced the historical development of computing devices.		I	R
104 — Tell about the history of Silicon Valley.			I
703 — List the characteristics of each generation of computers.		I	R
C. Develop an understanding of how computers are used.			
201 — Explain ways computers affect our lives.		I	R
202 — List several ways that computers are used in everyday life.	I	R	R
203 — Identify ways that computers are used to help consumers.		I	R
302 — Describe how computer simulations are used in problem solving situations.		I	R
303 — Identify ways in which computers help make decisions.			I
803 — Explain how computers are used in predicting, interpreting and evaluating data.			I
807 — Explain how computer models are used in testing and evaluating hypotheses.			I
1109 — List several ways computers are used to process statistical data.			I

	K-3	4-6	7-8
306 — List several sampling techniques and statistical methods used in the social sciences.			I
601 — Explain the meaning of "word processing."			I
801 — Describe the computer's place in our growing understanding of science.			I
204 — Illustrate the importance of the computer in modern science and industry.		I	R
304 — Explain how computer graphics are used in engineering, science, art, etc.			I
305 — Explain how computers are used as devices for gathering and processing data.			I
307 — Describe computer applications such as those consisting of information storage and retrieval, process control, aids to decision making, computation and data processing, simulation and modeling.			I
804 — Show that computers are best suited to tasks that require speed, accuracy and repeated operations.			I
805 — Describe situations which limit computer use (cost, availability of software and storage capacity).			I
208 — Describe some advantages and disadvantages of a data base of personal information.			I

Objective	K-3	4-6	7-8
209 — Describe problems related to the "invasion of privacy."			I
210 — Describe ways in which computers are used to commit a wide variety of crimes and how these crimes are detected.			I
D. Learn about computer-related career opportunities.			
205 — Identify career fields related to computer development and use.		I	R
206 — State the value of computer skills for future employment.			I
301 — Describe how computers are used by sociologists and other social scientists.			I
603 — Describe some of the ways computers are used in the information and language related careers.			I
802 — Show how a scientist would use a computer.			I
E. Gain a non-technical understanding of how computers function.			
1001 — Explain that a computer design is based on standard logic patterns.			I
713 — Explain the basic operation of a computer system in terms of the input of data or information, the processing of data or information, and the output of data or information.			I

Objective	K-3	4-6	7-8
716 — Describe how computers process data (searching, sorting, deleting, updating, summarizing, moving, etc.).			I
1108 — Describe the techniques computers use to process data such as searching, sorting, deleting, updating; summarizing, moving.			I
715 (1107) — Recognize the need for data to be organized to be useful.			I
1110 — Explain the statement: "Computer mistakes" are mistakes made by people.			I
806 — Identify common tasks which are NOT suited to computer solution.	I	R	R
709 — Define "computer program."		I	R
710 — Explain why a computer needs a program to operate.		I	R
712 — Recognize the relationship of a program, or input, to the result, or output.		I	R
714 (1106) — Evaluate output as to its reasonableness in terms of the problem to be solved and the given input.		I	R
717 — State what will happen if instructions are not properly stated in the precise language for that computer.		I	R
718 — List at least three computer languages and identify the purposes for which each is used.			I

Objective	K-3	4-6	7-8
719 – State that BASIC is one of the languages used most commonly by microcomputers.		I	R
720 – Explain the existence of several variations in BASIC.		I	R
F. Learn to use a computer.			
101 – Become familiar with a microcomputer through its use in the classroom.	I	R	R
102 (904) – Use a prepared program in a microcomputer.		I	R
1002 — State the meaning of "algorithm."			I
1003 — Explain what is being accomplished by a given algorithm.			I
1004 — Follow and give correct output for a given algorithm.			I
1005 — Describe the standard flow chart symbols.		I	R
1101 — Read and explain a flow chart.		I	R

…oduced; R = reinforced

Summaries of Other Exemplary Programs

Albany Unified School District

The Albany Unified School District has approximately 20 microcomputers for its 2,155 students, ranging from pre-school through grade 12 at five sites. The district hopes to expand its computer offerings in stages over the next few years.

The district's long range plan is aimed at "the goal of hands-on computer experiences" for every student.

The plan charts goals and objectives and implementation approaches, linking them to the hardware, staff development, new personnel and other elements projected to be necessary to reach each goal.

The three-year plan calls for a total estimated expenditure of $151,200, with $31,000 needed for the first year, $83,100 for the second year and $37,100 for 1984-85.

Emery Unified School District

The three-site (K-12, 518 ADA) Emery Unified School District hopes to expand to the high school the computer program it began with a Title II-funded pilot project in 1980.

The current program uses 24 microcomputers at two sites to provide hands-on computer experience to all K-6 students.

With an emphasis on reinforcement of basic skills, computer activities supplement classroom instruction in reading, language arts and mathematics Sixth graders learn the BASIC computer language.

Depending on grade level, each student, including special education and kindergarten students, spends from 30 minutes to 200 minutes a week in the computer resource room. With parental permission, students may also visit the resource room after regular school hours — and many do.

A Title IV grant has provided four years of staff development beginning even before the advent of the Title II project. Computers were an integral part of the Title IV project which was primarily aimed at countering students' math avoidance.

Fresno Unified School District

In preparation for a projected computer science and mathematics magnet school, the 46,804 ADA, K-12 Fresno Unified School District planned the curricula for computer assisted instruction and computer science instruction. While current school funding makes implementation of the planned-for magnet school uncertain, the report includes a review of current computer usage in the district and curriculum and hardware recommendations.

When the report was submitted in 1981, the district had 70 computers, mostly micro-computers.

The report identifies specific instructional applications by grade, course and discipline to meet certain objectives and includes sample lab materials and a review of network systems for schools.

The curriculum includes outlines of seven courses: beginning computers I and II, computer science I and II, microcomputers in business, programming in COBOL, and programming for math and science (FORTRAN).

The report also notes the potential for computer use in existing courses such as those in clerical office practice (the automated office), creative writing (using word processing for writing and editing) and mechanics (to graphically illustrate the workings of an engine, for example).

Mother Lode Union Elementary School District

The two-site (K-8, 1,159 ADA) Mother Lode Union Elementary School District entered the computer education field in 1981. After some teachers had begun using their own personal computers in their classrooms, the district made some preliminary studies (including a visit to the Cupertino School District to see the program described at the beginning of this chapter), presented workshops on computers for school employees and purchased two computers with categorical funds.

When the district authorized the purchase of more hardware, a phase-in plan was developed.

Goals and objectives were developed in five areas: computer awareness, computer literacy, computer managed instruction, computer assisted instruction and office applications.

Most of these goals and objectives apply to the board, students, site councils and staff.

The plan includes training programs for staff as well as student curricula, with timelines through 1984 for each.

The plan calls for the formation of a district-wide micro-computer committee to examine programs and make recommendations for future direction. Site councils would also periodically review progress in the plans for computer integration.

Redwood City School District

In 1981-82, the 13-site (K-8, 6,760 ADA) Redwood City School District formed a task force which developed a preliminary guide to assist staff in making computer-related decisions.

The guide includes information on meeting policy requirements, developing bid quotation specifications for materials and equipment and a microcomputer selection process (checklist).

The task force also developed a continuum for computer literacy for the district's instructional program. This sequential approach, covering all nine grades, includes: computer education (skills, understanding, terminology), computer interaction (how to operate a computer), software curriculum supplement (cross-discipline approach), and problem solving/programming (application of previously-acquired knowledge).

Staff development includes a teacher inservice computer fair to provide hands-on opportunities for staff.

In its computer philosophy, the school board supports computer literacy through computer use in instruction, regular hands-on computer experience and the opportunity to participate in computer assisted instruction.

San Anselmo School District

The (1,035 ADA, four-site K-8) San Anselmo School District in Marin County has established a computer lab at its only 7/8 grade school along with minimal programs in each of the three K-6 schools.

With a goal "for every 7/8 grade student to graduate computer literate," the district offers seventh-graders a nine-week computer literacy course. In the first part of the course, students study historical developments and are given an introduction to hardware, software and computer systems. The second part covers the use of the computer as a problem solving tool, introduces BASIC programming and reviews the limitations of the computer. Students explore computer applications, systems and concepts in the final section of the course.

About half of the seventh-graders have taken advantage of this opportunity. In addition, a more concentrated nine-week beginning class in computer programming and problem solving is open to interested seventh- and eighth-graders.

The K-6 component of the computer literacy course is limited by the small number of machines available at those sites. The elementary program provides students and teachers with an opportunity for computer contact and familiarity.

The district recognizes a need for coordinated programs with the high schools and "expanded financial support," to develop the many possibilities it sees for computers — in science, art, social studies, language arts and many other applications.

Prescott Unified School District

Using Title IV-C and Arizona's vocational education monies, augmented by district funds, the Prescott Unified School District initiated its computer literacy project in 1979 for its 1,788 students in grades four through 12.

Starting with 32 computers, by 1981 the program had grown to 100 computers with printers and disc storage.

Two sets of 12 computers are rotated on a quarterly basis to serve the district's five elementary schools. With a ratio of two students per computer in the four-week course, elementary students study the history and social implications of computers, careers, and then go on to actual programming and problem solving.

Each of the district's two junior high schools require at least six weeks of computer science linked to the seventh grade science course. Both offer an elective advanced course in the eighth and ninth grades. Gifted students at both schools are allowed to use the computers on an individual basis.

The high school offers a beginning and an advanced course and students who show exceptional aptitude may continued their computer education through the local community college, while still in high school.

The community college also cooperates in training the district's teachers. With this training, computer applications have expanded beyond the computer literacy program into math, word processing and to solve a variety of learning and administrative problems.

How A Computer Works

"Educational institutions should . . . empower people to enjoy and use developing technology, not (like Charlie Chaplin) be controlled by the new-machines."

Bruce Fuller, Governor's Office
(1982)

Chapter IV
How A Computer Works

There is nothing mystical about the workings of a computer. Contrary to commonly held beliefs, the computer does not think; it cannot assume control of the world by itself; it is not magical. It cannot work without directions, just as a hammer cannot drive a nail by itself.

Switches

The fundamental principle upon which a computer is built is the ability of an electronic circuit to change from a '0' state to a '1' state.

It is analogous to the electric circuit that controls the "on," "off" state of an electric light. The computer derives its power from being able to turn "on" and "off" the electronic circuits at a very rapid rate, consistently and reliably every time.

The only differences between the light switch and computer switch are speed and size. The computer switches can be turned "off" and "on" at one billionth the speed of the light switch, but the principle is the same.

In a computer, "on" and "off" are represented by "0" and "1." Computer size is essentially the factor which limits the complexity of the problems the machine is able to solve. The more zeros and ones, the more the capability.

Speed

Switching rates are so fast they are measured in terms of milliseconds, microseconds, and nanoseconds. A millisecond is one-thousandth of a second; a microsecond is one millionth of a second; and a nanosecond is one billionth of a second.

The switching speeds of these circuits are hard to imagine. For example, the blink of an eye takes about one-tenth of a second, or 100 milliseconds. A microsecond (one-millionth of a second) is a thousand times as fast as a millisecond, so the time interval of a nanosecond is actually incomprehensible. Technology advances will soon allow development of circuits that will operate at picosecond speed (one trillionth of a second). To illustrate:

SECOND	1. (1×10^{0}) SECONDS
MILLISECOND	.001 (1×10^{-3}) SECONDS
MICROSECOND	.000001 (1×10^{-6}) SECONDS
NANOSECOND	.000000001 (1×10^{-9}) SECONDS
PICOSECOND	.000000000001 (1×10^{-12}) SECONDS

Ordered Sequence

To be effective, the computer needs more than speed. The computer must perform at this speed in an ordered sequence. It must operate within a certain structure or framework as outlined in the computer specifications.

To achieve useful work there must be a machine cycle, instruction cycle, and execution time. Each machine has a specified time (machine cycle) in which it can perform a machine operation. This is usually limited by the technology or the architectural structure of the machine. Depending upon the instruction, several machine operations may be required to complete the task.

The instruction cycle is the time that is needed by the computer to interpret the instruction. During this time the computer must decide what has been requested of it to do.

The execution time is the time in which the computer actually performs the instruction.

Binary System

In order to communicate with the computer, the user must use a code that is understood by the computer. The code that has been developed for computers is the binary system. It differs from the decimal system (ten decimal symbols) in that the binary system uses only two symbols (0, 1) for all manipulations. The 0 digit means 'no' value and the 1 digit means a 'yes' value.

The computer achieves all of its complex, lengthy and accurate calculations by using zeros (0) and ones (1).

To achieve desired results, the binary system must be organized into a certain format and followed consistently. As an example, let's look at the binary representatives of the number 57.

Most computers are organized around 8 bits (a byte) of '0's and '1's. Assuming this is the case, the number 57 is represented as follows:

8 bit binary word: 0 0 1 1 1 0 0 1

The decimal equivalent is, starting from *right to left* using the binary system:

	(128)	(64)	(32)	(16)	(8)	(4)	(2)	(1)
=	0×2^7	$+1 \times 2^6$	$+1 \times 2^5$	$+1 \times 2^4$	$+1 \times 2^3$	$+0 \times 2^2$	$+0 \times 2^1$	$+1 \times 2^0$
=	0	+0	+32	+16	+8	+0	+0	+1
=	57							

The 8 bit binary word indicates that there are "yes" values in positions 1, 8, 16, 32, and "no" values in positions 2, 4, 6, 7. Adding up the values yields 57. The computer does this operation at incomprehensible speeds, with accurate results.

The Binary Coded Decimal (BCD) is the basic code used by most computer systems to represent numbers and alphabetic characters, punctuation marks, or special symbols. To expand the capability of the code to handle additional characters, the BCD system has been expanded to the Expanded Binary Code Decimal Interchange Code (EBCDIC). This provides for more character sets such as upper case, lower case letters, special control characters, graphic control characters, providing more capability for the computer.

In EBCDIC the alphabet is represented by the binary zeros and ones as follows:

a	1000 0001
b	1000 0010
c	1000 0011
d	1000 0100
A	1100 0001
B	1100 0010
C	1100 0011
D	1100 0100

. . . and so on.

In EBCDIC, the first five binary numerals and equivalent decimal values are shown below:

Binary	**Decimal**
0000 0000	0
0000 0001	1
0000 0010	2
0000 0011	3
0000 0100	4
0000 0101	5

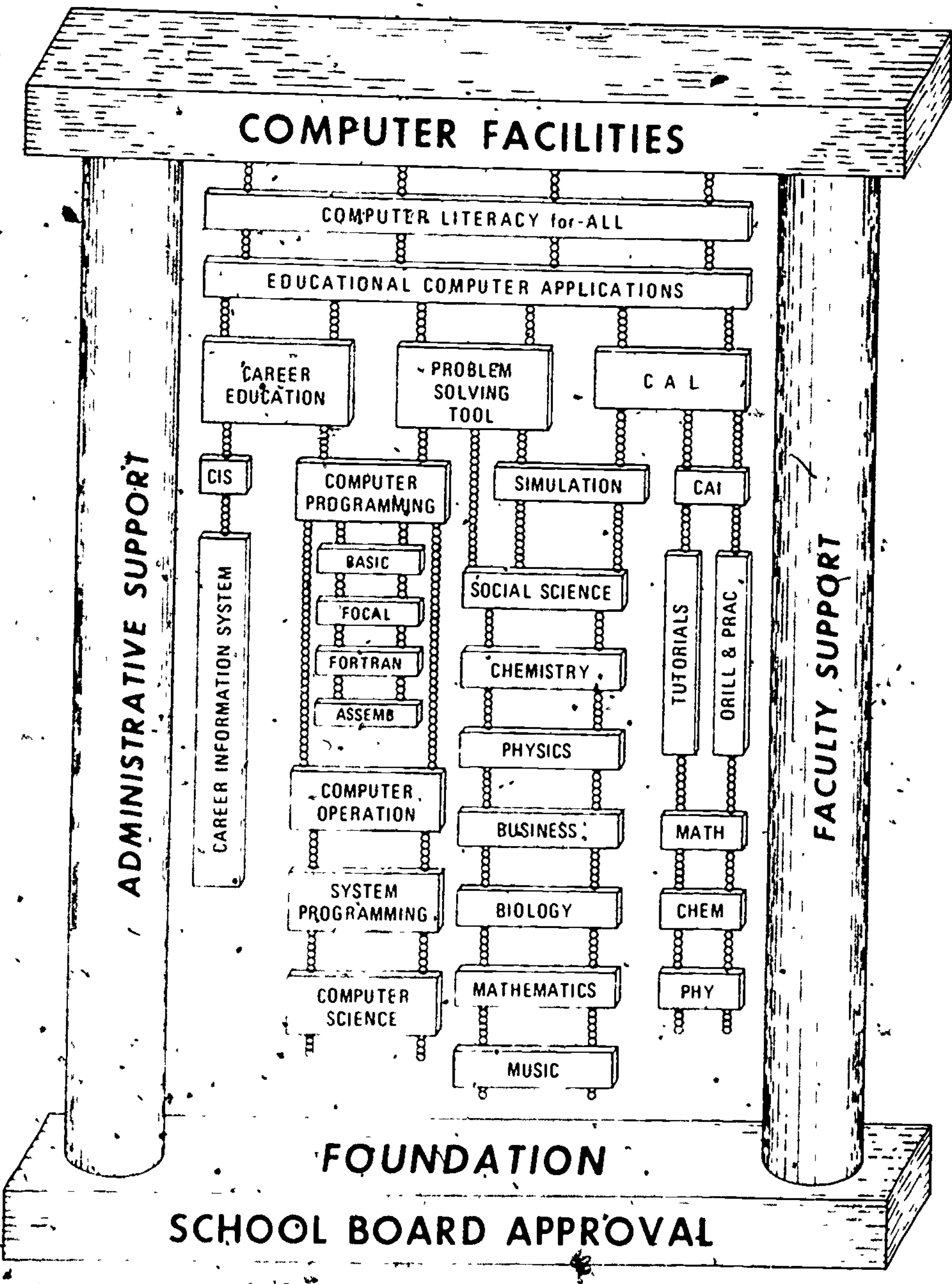
Languages

Programming languages have been developed to facilitate human/computer interaction They allow the user to talk to the machine in a language that both the user and the machine understand. With this language, the user can tell the computer exactly what operations to perform. Programming languages are different for different applications. The computer will respond differently for certain types of programs. Therefore, the programming language will be an integral part of any computer system.

Summary

In summary, the computer is not a brain or whiz kid. It is simply a collection of electronic devices capable of being set to a one (1) or zero (0). These devices are organized in a format that will allow for the processing of data. The system uses an EBCDIC code system to perform system operations. Programming languages are employed for users to communicate with the computer.

Conclusion



Structure designed by Mr Jaquiss, *Instructional Computing . . Ten Case Studies*, Human Resources Research Organization (1978), p. 171.

Conclusion

The Computer Literacy Task Force recognizes the need for computer literate students and, based on that, feels computers must exist as a curricular option. The needs for the future as well as the present must be addressed.

The task force found that a positive philosophic posture on the part of local school boards is necessary in order to meet particular student needs in the near and long term. That philosophy should be expressed in a disciplined manner such as a commitment on the part of local boards to set aside a portion of the annual budget, such as 1 or 2 percent, for acquisition of computer equipment or software and establishing training proficiency programs in the use of that equipment.

The survey responses reveal that many school districts have already made that commitment. According to the survey, most school districts are acquiring computers of some sort. What appears to be a common problem is the appropriate selection of hardware and software.

Because fiscal problems have somewhat jeopardized assistance and planning at the state level, the task force felt that the initiative for introducing new equipment and new technology to school districts must come from the local level.

This book was written to assist local board members in taking the necessary first steps toward computer literacy for themselves and for the students whose lives will almost certainly be affected by computers.

In general, the task force concluded that:

- Computer literacy has become and will continue to be a critical need for public school districts.
- Initial studies demonstrate that more learning occurs with the aid of a computer than by traditional approaches.
- Acquisition of equipment, software and training should have some commonality from district to district.
- Acquisition of the equipment and training is difficult at best, but requires a commitment on a sustained basis from local school boards.

- The school district's attitude, as long as it is positive, brings local citizenry into the process as a potential source of help both financially and educationally.
- The education should be continued beyond the kindergarten through twelfth grade programs.
- Equipment, training and software must be continually updated, necessitating a steady state expenditure on an annual basis.

In Summary

The task force found computer literacy to be an opportunity for local school boards to take the initiative in an area vital to the future of educational curriculum and operations.

Survey Results Summary

Appendix A

Computer Glossary

ALU (Arithmetic Logic Unit) — A basic portion of computer hardware, the element of the central processing unit that performs the arithmetical and logical operations of a digital system.
Auxiliary Storage — Usually a magnetic storage device, connected to the central processing unit, used to store programs and data when they are not being executed in main storage. A disk drive unit is the most common device.
Batch Processing — Technique of executing a set of programs such that each is completed before the next program begins (serially).
BIT — A binary digit (either a 1 or a 0).
BPI — Bits per inch. (Normally associated with magnetic tape.)
BPS — Bits per second. (A measurement of transmission speed.)
BUG — (1) A logic error in programming. (2) A malfunctioning hardware circuit.
BYTE — The representation of a character or number.
Central Processing Unit (CPU) — The unit of a computer that includes the circuitry controlling the interpretation and execution of instructions, the ALU, the main storage.
CAI (Computer Assisted Instruction) — Computer programs used by a student for drill and practice.
Communication Link — Any medium, such as wire, microwave, or telephone circuit, that connects a remote station to a computer.
Compiler — A program to translate a high level language, such as RPG II or COBOL from its source form into machine language.
Computer — A data processor that can perform substantial computation, including numerous arithmetic or logic operations, without intervention by a human operator during the run.
Configuration — The group of machines and devices that make up a data processing system.
CPS — Characters per second.
CPU — See Central Processing Unit.
Crash — A crash can occur when an internal computer part fails.
CRT (Cathode Ray Tube) — A device that presents data on a video screen (often called tubes, screens, displays).
Cursor — An underscore character on a cathode ray tube that indicates where the next character will be entered:

Data — Any representations such as characters, or analog quantities to which meaning is, or might be assigned.
Data File — A collection of related data records organized in a specific manner. For example, a payroll file (one record for each employee, showing his rate of pay, deductions, etc.) or an inventory file (one record for each inventory item, showing cost, selling price, number in stock, etc.)
Data Processing — Series of planned actions on data to produce some desired results.
Debug — To detect, locate, and remove mistakes from a routine or errors from a computer program.
Diagnostic — Pertaining to the detection and isolation of a malfunction or mistake.
Digit — In decimal notation, a digit is one of the characters from 0 to 9. Synonymous with numeric character.
Disk — The disk, which contains programs and data, is the principal means of storing information in the computer. It is similar in appearance to a photograph record, and is enclosed by a protective covering.
Disk Drive — A unit which spins disks or diskettes and reads or writes information on them.
Diskette — A single mylar ferrous-oxide coated magnetic disk which is used to record data in machine readable form, used for backup or data entry. This is also referred to as a FLOPPY.
Documentation — Written document(s) which provide sufficient information for a competent individual (operator, programmer, or user) to keep a system running.
EDP — Electronic Data Processing.
Execute — To carry out an instruction or perform a routine in the CPU.
File — A set of related records treated as a unit, e.g. all customer records would be a customer master file.
Flowchart — A graphic representation for the definition, analysis, or solution of a problem, in which symbols are used to represent operations, data, flow, equipment, etc.
Hardware — Physical equipment, (i.e. mechanical, magnetic, electrical, or electronic devices).
High Level Language — A programming language designed to make the programmer more productive.
Index — An ordered reference list of the contents of a file containing the key and the physical address on disk of each record.
Information — Data presented in a meaningful manner.

Input/Output (I/O) — A general term for the equipment or process used to communicate with a computer.
Instruction — In machine language, a statement that specifies an action to be performed and the address of the data to be manipulated.
Interface — The place or places at which two separate systems or portions of each join or interact.
Job — A specified group of tasks prescribed as a unit of work for a computer. By extension, a job usually includes all necessary computer programs, linkages, files, and instructions to the operating system.
K — 1024 bytes.
Keyboard — An arrangement of keys by which a machine is operated or by which data is entered.
Keypunch — A keyboard actuated device that punches holes in a card to represent data.
Language — A set of conventions and rules by which a programmer prepares computer instruction.
Line Printer — A device that prints all characters of a line at one time.
Load — To bring a machine language program from auxiliary storage into main storage for execution.
Local Network — The hardware and cable configuration pertaining to the attachment of terminals normally within 1 wire-mile.
Megabytes — One million bytes.
Memory — The storage facilities of a computer.
Microcomputer — The smallest category of computers whose main processing parts are made of semiconductor integrated circuits.
Minicomputer — A computer larger than a microcomputer and smaller than a larger general purpose computer.
OCR (Optical Character Recognition) — The machine reading of printed characters through the use of a light-sensitive device.
Output — The data which has been processed by the CPU.
Password — A unique string of characters that a user must supply to meet security requirements before gaining access to data.
Peripheral Equipment — Any unit of equipment, distinct from the central processing unit, which may provide the system with outside communication or storage.
Program — A series of instructions designed to achieve a certain result.
Programmer — A person who designs, writes, and tests computer programs.
Prompting — A function that assists a terminal operator by requesting necessary data.

RAM (Random Access Memory) — A memory chip used with microprocessors. Information can be written into and read out of this memory and can be changed at any time by a new write operation. The contents are lost when the power is shut off.
ROM (Read Only Memory) — A medium for storing, in permanent, non-erasable form, programs with one group of frequently used instruction The programs cannot be changed by the user and are not lost when the power is turned off.
Read — The physical movement of data from a device to the CPU.
Remote Network — The hardware configuration pertaining to devices that are connected to the CPU over telecommunication lines.
Run — To cause the computer to follow a set of stored instructions in order to perform a task.
Security — Prevention of access to or use of data or programs without authorization.
Simulation — The ability of a computer to portray a real life situation before the even actually occurs.
Software — Computer programs.
Source Program — A computer program written in a high-level language, such as RPG II, which requires translation into machine language prior to execution in the CPU.
Spooling (Simultaneous Peripheral Operations On-Line) — The reading and writing of input and/or output job streams onto a disk concurrently with program execution in a format convenient for later processing or output operations The spooling program allows the CPU to operate at its maximum speed without depending on its slowest input or output devices.
Store — To retain data in a storage device.
Syntax Errors — Violation of the rules of a programming language.
Telecommunications — Pertaining to the transmission of data over common carrier lines, such as telephone lines.
Terminal — A device, usually equipped with a keyboard and printer or display, capable of sending and receiving information over a communication line.
Time Sharing — A method of using a computing system that allows a number of users to execute programs concurrently and to interact with the programs during execution.
Turnaround Time — (1) The elapsed time between submission of a job to a computing center and the return of results. (2) In communication, the actual time required to reverse the direction of transmission from send to receive or vice versa when using a half-duplex circuit.

Update — To modify operational data in a master file with current information according to a specified procedure.
User — Anyone who requires the services of a computing system.
Virtual Storage — A technique by which auxiliary storage becomes an extension of main memory.
Word Processing — The use of electronic equipment to create, view, edit, manipulate, transmit, store, retrieve, and print text material. (This document was created on a word processor).
Workstation — Any device that can be on-line to the CPU. Typically, these are terminals and printers.
Write — To record data in a storage device or a data medium. The recording need not be permanent, such as the writing on a cathode ray tube display device.
Zany — That which characterizes your state of being after reading this glossary.

Appendix B
Computer Languages

APL — A problem-solving programming language which offers special capabilities for handling arrays and for performing mathematical functions.

Assembler Language — A programming language that includes symbolic machine language statements in which there is a one-to-one correspondence with the instruction formats and data formats of the computer. One step above machine language in complexity.

Basic — An algebra-oriented programming language used for problem-solving by engineers, scientists, and others who may not be professional programmers.

COBOL (Common Business-Oriented Language) — A business programming language. One of the major high level languages for data processing.

FORTRAN (FOrmula TRANslation) — A programming language used primarily to express arithmetic formulas.

LOGO — An Interactive programming language for students in the elementary and intermediate grades. It has very simplified instructions which makes it very easy for students to learn how to program in it.

PASCAL — A general purpose programming language with a simple but elegant syntax, used for applications on both large and small systems.

Pilot — A computer language originally designed as an author language for computer-assisted-instruction (CAI). It is also used for teaching computer programming to beginners.

Appendix C

Survey Results: Summary of Computer Programs

Appendix C: Summary of Computer Programs

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
Alameda County					
Alameda County Office of Education	Glenn Fisher	Teacher training	Yes		K-12
Alameda USD	Carol Smart	Computer literacy; questions concerning cost and repair	No	PETS, two ancient TRS-80's Apple	
Albany USD	Richard Rosenquist, Assistant Superintendent	Copy Available	Yes	Atari, Apple TI, TRS-80	K-12
Emery USD	Kay Gilliland, Dir., Basic Skills through Microcomputers Lawrence Hall of Science, Berkeley, CA 94720 (415)642-4193		Yes	Doesn't say	K-6
Fremont USD	Ann R. Lord Bob Celeste	Recommendations for micros			
Fremont-Newark Regional Occupation Program		Data processing curriculum			

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
Murray SD	Bill Conley	Acquisition stage; computer awareness workshop, evaluation-hardware/ software	No		
Oakland USD	Ron Solis	CAI, CMI, programming; Staff development			3-12
Contra Costa County					
Pittsburg USD		Computer use comm.	No		
El Dorado County					
Mother Lode Union SD	Robert L. Edwards	Copy Available	Yes	Apple; TRS-80. VIC	
Fresno County					
Clovis USD	Shirley A. Bruegman	Developing scope and sequence document			
Fresno USD					K-12
Pacific Union SD	Mel Spenhoff/ Al Owen, Supt.		Yes	TRS 80 Lev. II Radio Shack	
Humboldt County					
Cuddeback Union ESD	Steven Lowder	Acquisition stage	No		K-8

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
Lassen County					
Long Valley ESD	Pamela Auld	Initial stages.			
Los Angeles County					
Glendale USD		JPL (CAD-CAM); math; administrative; bilingual adult education	Yes	Burroughs B-6800, Apple, TRS-80, Computer Curr. Corp.	K-12
Los Angeles County Office of Education	Jeanne Guertin James Rudolph	Micro planning handbook			K-12
Wm. S. Hart Union HSD	Sandy Katcher		Yes		10-12
Marin County					
Novato USD	Arthur Luehrmann Helen Joseph	Consultant's report on computer education		Commodore PET Apple	4-12
San Anselmo SD	Frank R. Elliott/ Jim French	Copy Available	Yes	PET; Apple	K-8 (7-8)
Mariposa County					
Mariposa County Office of Education	Erik Brúun	Special Education, math/physics, programming		Apple II, III Atari 800, 400	9-12

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
Monterey County					
Monterey County Office of Education	John Naisbitt	Copy Available Summer Computer Inst. (for educators); Computer Literacy Survival Package: 6 week course for teachers and administrators; Computers in the Classroom: curriculum decision guidelines; Learning Computer Literacy; What is Pilot?		Apple II	
Monterey County Office of Education	Tom Adamsen, Coordinator	PASCAL: for teachers with experience; Microcomputers for Computer Literacy Training to Students: needs and recommended budget; Computer Rentals to Public and Private Schools; Microcomputer Evaluation Center: proposed; Computer Literacy Teacher Training Course	No	Apple II	

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
Orange County					
Brea-Olinda USD	Peter J. Boothroyd		No		
Coastline Regional Occupation Program	Alfredo Chiri	Programming, information processing, word processing	Yes		
Fullerton SD			No		
Huntington Beach Union HSD	Glenn Dysinger	Use mainframe	Yes	IBM; Wang; Apple	9-12
Irvine USD					
Orange USD	Glenn Carlson, Basic Skills Coordinator	Introduction to computer programming	Yes	None Given	9-12
Placer County					
Auburn Union					
Placer County Office of Education	Chuck Wiederhold	Curriculum guides and continuums	Being adopted	Apple, Atari PET, TRS-80	K-12
Western Placer USD	John Bozzo		Being Developed	TRS-80	4-12

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
Riverside County					
Desert Sands USD	Mikek Hoy	Proficiency testing	No	Apple II	6-8
Jurupa USD	John P. Wilson, Assistant Supt.; Educational Services		Yes - 1 semester only; course outline enclosed	Apple II Plus	9-12
Perris Union HSD	Dr. Gail Wickstrom	Attendance accounting (micro management functions)	No	PET	
Sacramento County					
Del Paso Hts. SD	Gloria Edwards				
Folsom-Cordova USD	F. Andrus		Yes	PET	K-6
Sacramento City USD	Louise H. Leoni, Director Curriculum Services		Vocational Curriculum in High School	Hewlett Packard Micro 83	9-12 & Voc. Ed.
San Juan USD	Dave Hammond		Enclosed for 1st Semester	T 158, T 159 Compucorp 025 Compucorp 125	

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
San Bernardino County					
Chino USD	Dr. Bud Davis	Computer awareness and literacy continuum (based on Cupertino model)	Yes		4-8
Hesperia SD	Thomas M. Elder, Dir. of Inst. Services	Report on computers in Hesperia	Yes 17 programs	Data General 1700	
San Diego					
Dehesa SD	Robert D. Hobson	Vector 1+; Asking for material to program	No	Vector 1+	
Imperial Beach Elementary School		Computer literacy curriculum for the elementary school	Yes		K-8
National SD	George J. Cameron		Yes	TRS-80	4-6
San Diego County Office of Education	Robert A. Dean	Computer Fair for Educators (programming contest for 4-12)			
h Bay Union SD	Betty G. Rosmann		No	Apple II	1-6

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
San Francisco County					
San Francisco USD	Sam Dederianj Computer Task Force Project Director		In Progress		
San Joaquin County					
Manteca USD					
—Sequoia School	Joseph Wickham	Proficiency/ competency testing	Being Developed		K-8
—Lincoln School	Gary F. DeiRossi		No	PET	K-8
San Mateo County					
Hillsborough City SD		Computer programs		TRS-80	7-8
LaHonda - Pescadero USD	Reed Montgomery, Principal		No		
Redwood City SD	Robert E. Beuthel	Copy Available	Yes	Micros; TRS-80	
South San Francisco USD	Warren V. Hagberg Adm. Asst. to Supt.		Yes - (5 & 6 attached) sample lessons	Minicomputers Microcomputers	6-8 now K-12 in prog.

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
Santa Barbara County					
Santa Barbara County Schools	Bettie Day, Coordinator of Library & Resource Center Services	Classroom evaluation of microcomputers courseware, Cupertino curriculum, Micro-Bits-newsletter; List of microcomputer using educators and equipment	No		K-12
Santa Clara County					
Campbell Union ESD	Art Ring	Software evaluation	Yes	Radio Shack	K-8
Cupertino Union SD	Carl W. Krause, Superintendent	Computer awareness curriculum	Yes		K-8
Cupertino UnSD	Bobby Goodson	Copy Available	Yes	Micros	K-8
Santa Cruz County					
Santa Cruz City Schools	Dale E. Kinsley	Considering instructional uses			
Siskiyou County					
Dunsmuir HSD		Micro rental		PET	
rtz Valley SD	Marilyn Steward		No	Apple II, 64K	2-8

District	Contact Person	Comments	Curriculum	Computer Types	Grade Level
Solano County					
Solano County Office of Education	Suzanne Powers	1981-82 micro-computer plan (revised); Proposed 82-83 micro-computer plans	No		
Sonoma County					
Petaluma Jr. High	James L. Grau		In Progress		
Petaluma Sr. High	Linda Loy		Yes	Apple II plus Microcomputer	10-12
Santa Rosa City Schools	Kenneth Koppelman, Computer Chairperson	Introduction to computers	Intr. Yes	Apple II	9-12
Tulare County					
Visalia Unified SD	James L. Brinkman, Ed.D., Director of Second Education	In progress		IBM-34 Minicomputer Microcomputer	
Ventura County					
Hueneme SD	Dr. R.L. Miller	Micro as a management tool	No		
Monte Vista School					