1986

Factors relating to the acquisition of computer literacy and computer science skills in California high schools

Sarah Budinger Peterson
University of the Pacific

FACTORS RELATING TO THE ACQUISITION OF
COMPUTER LITERACY AND COMPUTER SCIENCE SKILLS
IN CALIFORNIA HIGH SCHOOLS

A Dissertation

Presented to the Graduate Faculty

of the

University of the Pacific

In Partial Fulfillment

of the Requirements for the Degree

DOCTOR OF EDUCATION

---

by

Sara B. Peterson

April 1986

This dissertation, written and submitted by

Sara Peterson

is approved for recommendation to the Committee on Graduate Studies, University of the Pacific

Dean of the School or Department Chairman:

Gary B. Hansley

Dissertation Committee:

R Ann Zinck, Chairman

T C Coleman

Bobby R Hopkins

Beth Breneman

Deann Christianson

Dated December 4, 1985

This study in lovingly
dedicated to my husband

Jon

and to
four beautiful women

Tide

Diane

Susan

Sybil

Acknowledgements

I wish to acknowledge:

Charlotte M. Peterson for showing support, encouragement and faith in me and my endeavor,

Dr. R. Ann Finck for giving expert guidance, sound advice and countless hours to my study,

Dr. T. C. Coleman for being the necessary catalyst,

Dr. Bobby Hopkins for being everybody's favorite teacher and for being patience personified,

Dr. Deann Christianson for giving the precise suggestions at the right moments,

Dr. Beth Breneman for being an essential link to data, a caring friend and a great support,

Dr. Thomas Williams for getting my mind on tasks and my research on paper,

Dianne Helms for contributing time, expertise, patience, and applause,

Beverley Lindfeldt for getting it all together.

FACTORS RELATING TO THE ACQUISITION OF
COMPUTER LITERACY AND COMPUTER SCIENCE SKILLS
IN CALIFORNIA HIGH SCHOOLS

Abstract of Dissertation

Purpose: The purpose of this study was to identify factors that related to the acquisition of computer skills in California high schools.

Procedures: The first part of the study was examination of data from a sample of 63 California schools: scores from computer skills tests, achievement tests, and other pertinent information.
The second part was an in-depth study of four schools taken from the sample of 63 schools with high or low scores on computer skills tests. Case study methodology was used with the sample of the two high scoring and two low scoring schools to examine other factors that may have contributed to the differences in scores.

Findings: Significant statistical relationships were found between the high scores on computer skills tests and parents' educational attainment. High percentages of recipients of Aid to Families with Dependent Children (AFDC) showed a negative correlation with the test scores. Significicant statistical relationships were also found between scores on reading and math tests and computer skills tests.

The case studies revealed differential access to computers based on ability, and a lack of integration of computer skills into the curriculum in the low scoring schools. The importance of teacher training, and the commitment of school and community to computer programs with high quality hardware and software were important factors in schools with high computer skills scores.

Recommendations: 1. Districts desiring to implement successful comprehensive computer programs should secure involvement of, and commitment from all aspects of the school and the community. 2. Administrators of programs should utilize additional resources in computer classes for those who have low reading and math scores. 3. Districts need to be wary of the relationship between sources of funding for computer programs and their classroom utilization, as this study indicates that categorical funding tends to result in "narrow" categorical use. 4. A recommendation for further study is the extent to which there is a division among the school districts of the state into "have" and "have-not" districts with regards to access to computer literacy courses for all students. Such a division, if it exists, might be of interest to the legislature as a matter of State Policy.

TABLE OF CONTENTS

(TABLE OF CONTENTS CONTINUED) Page

(TABLE OF CONTENTS CONTINUED) PAGE

(TABLE OF CONTENTS CONTINUED)

LIST OF TABLES

CHAPTER 1

Introduction

We are living in an era of technological revolution. It is a revolution of great magnitude; however, it may be a positive force--exciting and dramatic, especially as it may affect education (Hallworth, 1980; Shane, 1983). In an extensive account of the development and use of computers in educational settings, Hallworth and Brebner state that the magnitude of this revolution may be compared to the introduction of the printed word and the invention of the printing press (Hallworth, 1980).

Computers and their uses have developed at an extremely rapid rate in the past two decades (Charp, 1982; Naisbitt, 1982). Since the influence of computer technology in the public schools was inevitable, and the pace has become more and more rapid, educators are obliged to keep abreast of the changes resulting from the technological revolution (Evans, 1982; Papert, 1980).

Although we have lived in an age of computers for four decades, the early use of computers primarily had been limited to time-sharing and network use of the large main frame and smaller minicomputers, located in institutional settings. The introduction of the

microcomputer has made computers available to most public schools in the United States.

Educators cannot ignore the impact computers are having on education without risk to their credibility (Papert, 1980; Cowen, 1981; Seidel, 1982; Hallworth, 1980; Shane, 1983). Seidel reasoned that computer literacy courses in our schools are imperative because our society, collectively and individually, must handle increasing amounts of information, and members of today's society need to become better problem solvers. Computers have rapidly become a major component of the work environment and can solve problems and handle information effectively and efficiently (Seidel, 1982). Hamblen, (1978), writing about the societal impact of computers on education and manpower, predicted that high schools would become more and more involved with the teaching of computer languages, while consequently courses in colleges and universities would become remedial.

Computers are used in public schools for a variety of purposes, including administrative record keeping, drill and practice, tutorial instruction, word processing, computer literacy (CL) and computer science

(CS) instruction. Teaching CL and CS are currently regarded, by some, as the most appropriate use of computers in classrooms (Hamblen, 1978; Gephart, 1982; D'Ignazio, 1983; Johnson, 1980; Cowen, 1981).

The Purpose of the Study

Educators and social scientists supported the assertion that the acquisition of computer skills in high school was highly desirable and in many instances mandatory for functioning effectively in an age of high technology. Therefore, concerns about equal opportunities for high school students obtaining sufficient CL and CS skills to meet the demands of a technological society are raised. Issues of accessibility and/or equity in the provision of general education skills in public schools have been argued in courts of law (e.g., Serrano vs Priest). Therefore, the study of variables relating to the acquisition of computer skills has been of local, state, and national interest.

The purpose of this study was to identify relationships among dependent variables--acquired knowledge of computer literacy and computer science (as determined by test scores)--and independent variables that pertain to public schools. The

independent variables were average test scores for reading, math, and writing, and four socially controlled variables such as schools' size, socio-economic-status of parents, percentage of disadvantaged students, and geographic location. The study determined if the reading, math, and writing scores had predictive validity for computer skills scores. It also determined if the socially controlled variables stated above related negatively or positively to the ability of high school students to achieve computer skills. Currently, the assertions made in the literature indicated there were not equal opportunities in public schools for students to acquire computer skills. The results of the study provided an empirical basis for formulating conclusions related to equal opportunities in computer use.

Another purpose was to examine issues and trends that exist in public schools that may influence implementation of CL and CS programs. Particular attention was paid to issues that are administrative concerns pertaining to finance, personnel, facilities, and program.

Statement of the Problem

Although there has been much studied and reported about computers in education, most of the studies had been

mainly concerned with computer-assisted curriculum and related topics. There was a paucity of research about conditions in public school that fostered or hindered computer skill attainment. Therefore, questions were raised about whether reading, math, and writing scores had predictive ability for high attainment in computer skills or if there were other variables that might be considered more viable predictors in the administrative decision making process.

Other questions were raised about the educational and social milieu that could affect achievement in computer skills. This study attempted to answer the following questions:

1. Did schools where students' parents have high academic attainment have higher CL and CS scores than those with lower academic attainment?

2. Did schools that have high average scores in math, reading, and writing also have higher scores in CL and CS?

3. Did schools with a higher percentage of AFDC (Aid to Families with Dependent Children) recipients score lower on CL and CS than schools with a lower ratio AFDC?

4. Was the size of the school related to the

acquisition of computer knowledge as measured by CL and CS scores?

Hypotheses

1. There is no relationship between students' high CL and CS scores and parents' academic attainment.

2. There is no relationship between CL and CS scores and reading, math, and writing scores.

3. There is no relationship between the percentage of AFDC recipients in a school and the CL and CS scores of the schools' students.

4. There is no relationship between the size of the school and the CL and CS scores of the schools' students.

Some of the data used for this study were furnished by the California State Department of Education (SDE), Office of Program Evaluation and Research (OPER). The data were collected by the California Assessment Program (CAP)--a legally mandated program that assesses achievement in California Public Schools. In the 1982-83 school year, questions for measuring computer knowledge were added to the annual assessment of reading, writing, and math skills. Other pertinent data were obtained from the California State

Department of Education/Consolidated Program Description Database (SDE/CPDD-3, 11/84).

Schools were examined to attempt to describe conditions that may have contributed to high CL and CS scores. Data were obtained by the use of a case study approach. This aspect of the study was descriptive, and the analysis was concerned with matters of finance, personnel, facilities, and program.

Significance and Relation to Educational Administration

The results of this study have significance for public school administrators, because the variables relating to CL and CS achievement were examined in order to determine the predictive value and subsequent utility in the administrative decision making process. The resulting data provides a foundation for inferences that were made regarding how the accessibility of computers for students related to the acquisition of computer knowledge. SES of the school populations, school size, percentage of AFDC, and the academic emphasis within the school provided the focus for this analysis.

If variables, such as reading, writing, and math scores have high predictive validity for success in CL and CS courses then remedial and developmental courses

in reading, writing and math need to be considered as CL/CS prerequisites in curriculum design for those students who have not mastered basic requirements. If socially controlled variables (i.e., SES, AFDC, and size) have high predictive validity in CL/CS success, then implications for federal, state, and local policy initiatives may need to be considered to assure equity of accessibility to computer knowledge for all students.

The case studies were designed to reveal trends which addressed questions and highlighted issues of critical import for administrative consideration and decision making. Within the framework of finance, facilities, personnel, and program, comparisons were made between schools that showed evidence of greater success as measured by higher CL and CS scores with those that showed less success. Among the trends which raised important questions were:

1. The differential access to computer use instruction.

2. The amount of integration of computers in classrooms and curriculum.

3. The quantity and quality of software.

4. The preparation of teachers.

5. The level of commitment of the community, administration, and teachers to computer education.

Definition of Terms

The terms "computer literacy" and "computer science" as used in this study are defined according ~~to the instructional objectives from which the test~~ questions are derived. (See Appendix A)

CL (computer literacy): Computer literacy is described as the curriculum designed to enable the student to demonstrate understanding of the capabilities, applications, and implications of computer technology. The computer literate student will be able to:

(1) interact with a computer and/or other electronic devices; (2) explain the functions and uses of a computer system; (3) utilize systematic processes in problem solving; and (4) appraise the impact of computer technology upon human life.

CS (computer science): Computer science was a term used for coursework which required a student to be able to demonstrate understandings of computer systems including software development, the design and operation of hardware, and the use of computer systems in solving problems. The student will be able to:

(1) write structured and documented computer software;

(2) demonstrate knowledge of the design and operation of computer hardware; and (3) use computer systems in problem solving.

SES (socio economic status): SES was designated by the educational attainment of the parents as reported by the students on their test forms.

SIZE This term described the size of the school. In this study, the number of twelfth grade students tested was used as a substitute for size of school.

AFDC (Aid to Families with Dependent Children): AFDC, referred to the percentage of students in the school who were targeted as disadvantaged and who received compensatory aid.

Equity: As used in this study, equity meant a state of quality of being fair and equal. A goal for equity in education should read that each student is able to meet his/her full potential (Hoursund, 1984).

Accessibility: As used in this study, accessibility, referred to how obtainable computers and computer courses were to all students.

Urban and Rural Residence: "As defined for the 1980 census, the urban population comprises all persons living in urbanized areas and in places of 2500 or more inhabitants outside urbanized areas. . .

The population not classified as urban constitutes the rural population" (U.S. Department of Commerce, 1983).

Limitations

The study is based on average scores obtained by schools. The scores are from tests taken by twelfth grade students in California public high schools. Access to individual student scores and individual demographic data is not feasible for the scope of this study. These scores are obtained from data collected in the 1982-1983 school year by the California SDE Office of Program Evaluation and Research.

Assumptions

It is assumed that the data as collected and reported by the Department of Education were generally correct and that students were honest and accurate with their responses to the CAP test. Further, it was assumed that scores reported in the 1982-83 assessment were generalizable and representative of current conditions in the schools interviewed for this study. It was also assumed that responses to the case study interview questions which involved self-reporting were sincere and truthful.

Organization of the Remainder of the Study

The remaining chapters of this study are

organized as follows: Chapter Two is a review of the literature relating generally to computers in education and specifically to the acquisition of computer skills in schools. In Chapter Three a description of the sample, the instruments, procedures for data collection and methods of analyzing the data are presented. Chapter Four contains the results of the analyses. Chapter Five includes a summary of the findings, discussion, and recommendations for further research.

CHAPTER 2

REVIEW OF THE LITERATURE

This chapter was written to present a review of the literature relating to several aspects of computer use in education, particularly in public elementary and secondary schools. The review gave an historical account of the earliest types of computers and computer use in education.

Identified in the review were a few of the outstanding pioneers who were most influential in the field of computer education. Also touched on was the dramatic impact of the microcomputer and its uses in the public schools.

Some of the results from a national survey of microcomputer distribution in the public schools also were included. Many of the survey's findings related directly to this study.

The historical perspective was intended to present a framework for the focus of the research which studied factors that pertain to the acquisition of computer skills in high schools. The latter part of the review, therefore, concentrated on issues of acquisition and equity to computer use in public schools.

Computers In Education -- An Historical Perspective

A Revolution in Education

The age of computers has produced a technological revolution of great magnitude, especially as it has affected education. Hallworth and Brebner (1980) compared the magnitude of the revolution to that of two other revolutions in history that had also affected education:

> Looking back into history only two other revolutions of comparable dimension can be identified. The first of these was the introduction of the written word. Before this all instruction had . . . taken place verbally. Although it is not known when written records were introduced, there were, as early as the fifth century B.C., objections that the use of written information made learning less stimulating and interesting, and unadaptive to individual student needs . . . (The) second revolution . . . (was) the invention of the printing press in the fifteenth century. Again it met with some resistance and educators of the time expressed doubts about its value. They regretted the lessening of emphasis placed on the

skills needed to produce the intricate hand-written manuscripts. . . . It was not until the end of the eighteenth century that books were used extensively in schools, (Hallworth and Brebner, 1980, p. 3, 4).

In the 1960's the use of computers for educational purposes was considered by some to be revolutionary (Hallworth, 1980; Papert, 1982), by others to be another trend that had caught the fancy of educators (Noble, 1984). Used in educational programs for over twenty years, computers have shown promise that there will be continued use (Coburn, 1982). Educators can not ignore the impact computers are having on education without risk to their credibility (Hallworth, 1980). The influence of computer technology is inevitable in the public schools (Evans, 1982), and the study of computer use in schools is a subject of local, state, and national interest (Evans, 1982; Papert, 1982).

"In the computer revolution . . . we have seen warehouse-size mainframes shrink to manageable proportions, the introduction of minicomputers no larger than standard filing cabinets, and finally desk top microcomputers" (Ballas, 1983). One of the

earliest computers, ENIAC, became operational in 1945, at the University of Pennsylvania. Weighing thirty tons, the ENIAC contained more than 18,000 vacuum tubes (Hallworth, 1980). Only forty years later a computer could be carried by a child and surpassed the power of mainframes used in the 1950's to control air defense systems (Grayson, 1984). Predictions are that by the year 2000, 100 million computers the size of the largest systems currently available will be on one micro chip (Ralston, 1976).

During the past three decades, the three main types of computers developed were the mainframe, the minicomputer, and the microcomputer. The mainframe is a very large computer that is capable of processing vast amounts of information very guickly. UNIVAC computers are examples of mainframe computers. Use of mainframe computers was limited to the purchase of computer time from those institutions that could afford the large expensive equipment (Walker, 1980; Charp, 1982).

The minicomputer, smaller in size and less costly, came into wide use in the 1960's, allowing time-sharing customers of large centers to purchase and operate their own computers. Large school

districts and districts heavily funded for compensatory education were able to purchase minicomputers for administrative purposes and for computer-assisted instruction (CAI), (Charp, 1982).

The invention of the microprocessor, a tiny electronic computer engraved on a small silicon chip, made microcomputers ubiquitous and computer use commonplace. Computers became a commodity within a price range which made them available to many schools as well as households (Gephart, 1982). The development and proliferation of microcomputers spurred increased interest in the public schools in the use of technology to improve educational quality (Grayson, 1984).

Computer-Assisted-Instruction (CAI)

The history of the use of computers in education dates back to the 1960's. During that time a major effort was launched to promote the educational potential of computers. Spending millions of dollars, government agencies, university researchers, and computer manufacturers were involved, and an "educational revolution" was declared (Coburn, 1982). The period of the sixties was one of heavy investment in research and development in educational technology. Coburn

stated that "despite a rather extensive publicity campaign carried on in educational circles by the government, the computer manufacturers, and advocates of computer assisted instruction, none of this research had much immediate impact on mass education".

Although there were successful evaluations, the CAI projects of the sixties did not become a significant ongoing part of many school programs. Primary among the reasons were the cost of the hardware needed to reach masses of students and the cost of developing quality educational software (Coburn, 1982). However, several of the projects, adapting to the use of the microcomputers, have remained effective instructional programs (Bork, 1984).

The first CAI programs developed to aid the teaching of mathematics and reading were at the Unversity of Illinois, Urbana, in 1960, at Stanford University in 1963, and at the University of Texas in 1971. These three pioneer programs set the stage for later development in CAI and provided a substantial knowledge base which continued to grow as more and more educators were using computers for instructional aid (Hallworth, 1980; Charp, 1982).

The University of Illinois project called Programmed Logic for Automatic Teaching Operation (PLATO) was located in the Computer-based Education Research Laboratory (CERL). Under the direction of Donald Bitzer, PLATO programmed instructional material in over 140 subject areas, including engineering, pure science, social science, medical science, mathematics foreign language, and business using all models of computer assisted instruction: tutorial, drill-and-practice, simulation, and games. PLATO materials are used in many diverse institutional settings (Hallworth, 1980; Coburn, 1982; Grayson 1984).

Developed at the University of Texas, a system known as Time-shared, Interactive, Computer Controlled Information Television (TICCIT), was the transitional system that bridged the gap from the large mainframe computer of the 1960's to the use of the microcomputer in the 1970's (Charp, 1982; Grayson, 1984). An experimental system, no longer in existence, TICCIT used stand alone minicomputers to which terminals were connected that incorporated standard television sets. Teams of instructional developers created courses for the system (Grayson, 1984), and like PLATO, "received millions of dollars of government money and then generated commercial spin-offs" (Bork, 1984 p.94).

Established in the Institute for Mathematical Studies in the Social Sciences, the Stanford project, under the direction of Patrick Suppes received large grants from private and federal foundations. Courseware was produced in the area of mathematics, reading, and language arts at the elementary school level. The CAI program was started in 1965 in an elementary school 12 miles from Stanford University, in the center of a middle class, suburban community. There were approximately 270 students in the original CAI project (Suppes, 1968).

The mathematics drill-and-practice program was expanded in 1966 to include over 1500 students in a geographical area around the Stanford campus. The program then expanded via teletypes over phone lines which connected schools in remote areas in Kentucky with the computers at Stanford. Over 1500 students were enrolled in CAI in Kentucky, then 640 in McComb, Mississippi, and 500 in Jobs Corps Center in Iowa. The results of Suppes' data indicated, among other things, that "an individualized drill-and-practice program in elementary mathematics will produce its most impressive results in school environments not educationally and economically affluent" (Suppes, 1968, p. 349).

While Suppes was developing the CAI program for mathematics at Stanford, Richard Atkinson was responsible for the initial reading curriculum. The reading CAI program was "tutorial" in nature. Atkinson explained, "Tutorial programs have the capability for real time decision making and instructional branching contingent on a single response or on some subset of the student's response history. Such programs allow students to follow separate paths through the curriculum based on their particular performance records" (Atkinson, 1968, p. 226). The differences in the CAI programs are explained by Vinsonhaler (1972, p. 30): "Drill-and-practice systems may be defined as CAI systems designed to assist a learner in the maintenance and improvement of a skill. By contrast tutorial systems are designed to assist a learner in the acquisition of a skill."

The materials developed by Suppes and Atkinson are still widely used in California schools. Computer Curriculum Corporation (CCC) is an outgrowth of Suppes' research in the early 1960's. A company spokesman reported 28,000 students in 35 school districts in California use CCC-CAI programs. The CAI

was geared for basic skill development and used on minicomputer systems; however more recently, CCC developed CAI for use on Sony microcomputers (Fortune, 1983).

Visonhaler and Bass reviewed most major studies involving CAI up to the year 1972. The summary included the results of ten independent studies of CAI drill-and-practice, involving over 30 separate experiments, with about 10,000 subjects within the content area of language arts and mathematics. Their findings concluded that "in the controlled studies applying drill-and-practice to language arts and mathematics, there seems to be rather strong evidence for the effectiveness as measured by standardized achievement tests" (Vinsonhaler, 1972).

An ambitious study was conducted by Jamison and others in 1974, to determine the effectiveness of what he termed "alternative instructional media". Included in the alternative instructional media were instructional radio (IR), instructional television (ITV), programmed instruction (PI), and computer assisted instruction (CAI). Jamison concluded that CAI improves the "quality of instruction by providing for its individualization along one or more dimensions"

(Jamison, et al, 1974). He added that although in some studies there was shown no significant difference in achievement, other factors made the use of CAI advantageous (e.g., economical use of time for student and teacher).

~~Wells replicated research done by Suppes but~~ gathered substantially more data than was previously available. He included other variables that enabled the researchers to examine background characteristics of students and their teachers and the number of CAI sessions each student received. Also, he limited his study to 446 subjects in grades 5 and 6 who scored below norm on the Comprehensive Test of Basic Skills (CTBS). His study revealed that CAI had a significant and positive impact on achievement in most cases, and that 100 five to ten minute CAI sessions during the course of a school year can raise a disadvantaged student's grade level by perhaps .3 of a year over what the student would gain otherwise. Also revealed was that the cost of the compensatory program was considerably less than most alternative compensatory education programs (Wells, et al., 1974)

Sylvia Charp, the Computer-Managed-Instruction (CMI) administrator for Philadelphia School District, reported in 1976 that the drill-and-practice

mathematics CAI programs were most successful. During the 1975-76 school year, over 2000 children in grades 4 through 12, for the most part, achieved a year's increase in reading level during the academic year. In the mathematics program most students, using CAI, were able to complete more than 33 blocks of the program. Twenty-four blocks were considered equal to a year's work. Other findings by Charp were that students with CAI became bored less readily and had only mild dissatisfaction with the system (Philadelphia School District, 1976).

Increasingly apparent through the more recent literature which examines the effectiveness of CAI programs are discoveries of extraneous advantages of CAI over and above achievement. With twenty years of existence and still in many ways in its infancy, CAI has proven to be, especially in mathematics and language arts, the impetus education has needed (Carver, 1981; Bell, 1978).

Dense listed 39 variables addressed by CAI research done by 17 researchers between 1970 and 1978 (Dence, 1980). Prominent among the variables were subject matter, branching, feedback, individualization, CAI versus TI (traditional instruction), time and

student variables. Dence suggested that although extensive efforts have been devoted to developing computer programs to help students obtain, review, and apply knowledge, CAI was not being used as widely or as effectively as it might have been. Dense contended that further research in areas such as locus of control, split-brain research, cognitive style, anxiety level, and personality types would assist educators in building upon CAI's strengths as a tool for individualization (Dence, 1980).

With some exceptions, research has shown that grades in mathematics have improved considerably with the use of CAI. Del Forge asserted that CAI had increased math scores beyond expectation and had provided a means of maintaining interest and accomplishment for students (Del Forge and Bloeser 1976).

In an article reporting on a meta-analysis of 51 separate research studies by Kulick, author Bracey grouped results of the research into three categories: "achievement, affective/motivational and social". The researchers, James Kulick and his associates at the University of Michigan, searched through roughly 300 studies dating back to 1960, selected 51 and rejected over 250 due to methodological flaws (Bracey, 1982).

Under Bracey's achievement category, studies showed that, with rare exceptions, students who received CAI scored better on ojective tests than students who received traditional instruction. He found that CAI improved retention and improved the speed at which students learned a given amount of material (Bracey, 1982).

Among the affective motivational gains, Bracey reported that CAI students emerged with more positive attitudes about computers, . . . and enjoyed the ability to move at their own pace. They were not embarrassed about mistakes and felt more in control of things (Bracey, 1982).

For Bracey's category "social outcomes", he stated that although the "hard" research is silent, many researchers have seen more collaborative, cooperative problem-solving among kids who are doing programming activities together than anywhere else in the schools (Bracey, 1982). He added the oft-expressed fear that computers had a dehumanizing effect by isolating students from their peers, appeared not to be grounded.

In the executive summary and policy implications of the Educational Testing Services/Los Angeles

Unified School District study the authors write:

> School systems for years have sought compensatory education techniques with three essential characteristics: effectiveness, replicability at different locations, and costs within typical per-student Title I allocations. Computer assisted instruction (CAI) appeared to offer promise as one solution to the challenge of compensatory education. Early work indicated that its cost fell well within per-pupil Title I allocations and that use of the mathematics curriculum over a period of one year improved student performance in mathematics. Since the curriculums were available for use with minicomputers or large mainframe computers, replicability of the drill-and-practice material could also be assured. If CAI curriculums could be conclusively shown, over several years, to provide a pedagogically effective intervention, then state and local educational authorities could be assured of having at least one demonstrably satisfactory compensatory intervention at their disposal (Ragosta, et al., 1982).

Ragosta implied further that the "advantages of the computer for drill-and-practice lies primarily in

the computer's efficient use of time. For only 10 to 20 minutes daily, truly individualized drill and practice can be used to instruct students at their own ability levels, to provide immediate feedback to each response, to move students ahead on the basis of their mastery of subject matter, to keep records of each student's placement in each strand of each curriculum, and to do all of these with demonstrable effectiveness over a period of years (Ragosta, et al., 1982).

Computer Literacy (CL). Computer Science (CS)

Another approach to the use of computers in education came about in the early 1970's. Educators began to talk about teaching "computer literacy" to students in elementary and secondary schools. Advocates of the new educational use of computers argued that by limiting the use of computers to CAI, we were shortchanging the students. We were effectively making them second class citizens of a society in which jobs, social status and influence would go to those who can understand and control computers (Luehrmann, 1972).

The term "Computer literacy" was coined by Luehrmann at Dartmouth College's Kiewit Computation Center and later Director of the Lawrence Hall of

Science computer science programs. To him, the term meant a level of understanding a set of skills associated with programming computers and using them as vehicles for personal expression (Luehrmann, 1972; Coburn, 1982).

Luehrmann wrote extensively to support his goals, which were to allow the public increased access to computers to use them as the powerful tools which they were. He repeatedly maintained that computer programming skills were as important for members of the computer-based society, as were reading and writing skills for a print-based society (Coburn, 1982). The term "computer literacy" came to be used indiscriminately with a wide range of definitions (Luehrmann, 1981; Gawronski, 1981; Tobin, 1981; Moursand, 1982). Nonetheless the term caught on and came to mean that computer literacy is simply the ability to utilize the capabilities of computers intelligently (Tobin, 1983, p.22).

In his book, Computer Literacy, Seidel (1982) gave three reasons for promoting computer literacy programs as:

1. Our country, collectively and individually, must handle increasing amounts of information.

2. Individuals need to become better problem solvers.
3. Computers are a major component of the work environment. They can help solve problems and handle information.

In 1981, Cowen cited a challenge to educators and parents in a position paper at the National Council of Teachers of Mathematics (NCTM):

> Mathematics programs must take full advantage of the power of computers at all grade levels. Students and teachers should obtain a working knowledge of how one interacts with computers and uses their capabilities. . . . Computer literacy is an essential outcome of contemporary education. Each student should acquire an understanding of the versatility and limitations of the computer through first hand experience in a variety of fields.

Cowen added: "Mathematics teachers seem prescient to insist that computer literacy join the three R's as an essential basic skill" (Cowen, 1981).

Federal involvement in the development of computer-based learning material was, as it was in the 1960's, important in the period of the 1970's. Projects such as Plato and Ticket (TICCIT) received

millions of dollars of government money, as did many institutions (Bork, 1984). The Educational Technology Center at University of California, Irvine, received funds from both the National Science Foundation and from the Fund for the Improvement of Post Secondary Education (Bork, 1984). The National Science Foundation and the U.S. Office of Education funded organizations such as the Minnesota Educational Computing Consortium (MECC), The International Council for Computers in Education (ICCE), and Far West Lab to research and develop computer literacy curriculum materials (Hathaway, 1983). From MECC and ICCE materials were produced at low cost for use with microcomputers in classrooms. From these organizations a definition of computer literacy requirements included nine topics: 1. History of Computers; 2. Hardware Terminology; 3. Knowledge of How a Computer Works; 4. Software Experience; 5. Programming Skills; 6. Languages; 7. Limitations of the Computer; 8. Uses/Misuses of Computers; 9. Computer Careers (Hathaway, 1983).

Cardinale (1982), for the purpose of establishing a curriculum for kindergarten through 12th grade, gave definitions for computer literacy and computer science.

By separating out program and instructional skills based on described objectives, the Department of Defense Dependents Schools (DODDS), under the direction of Anthony Cardinale developed a scope and sequence for educational computing. For the course in computer literacy, the DODDS manual stated: "The student will be able to demonstrate understanding of the capabilities, applications and implications of computer technology" The program objectives listed for computer literacy were:

1.1. Interact with a computer and/or other electronic devices.

1.2 Explain the functions and uses of a computer system.

1.3 Utilize systematic processes in problem solving.

1.4 Appraise the impact of computer technology upon human lives.

(Cardinale, 1982, pp 2,3).

For the course titled computer science, Cardinale set the following goal: "The student will be able to demonstrate understandings of computer systems including software development, the design and operation of hardware, and the use of computer systems in solving problems". The stated program objectives

for the computer science goal were:

2.1. Write structured and documented computer software.

2.2. Demonstrate knowledge of the design and operation of computer hardware.

2.3. Use of computer systems in problem solving. (Cardinale, 1982, pp 4, 5).

Instructional objectives were written for each program objective (see appendix A). To develop an evaluation for the DODDS computer education programs which are world-wide, a set of questions was designed under the ageis of the Northwest Regional Education Laboratory (NREL). The test questions were also used by the California State Department of Education (CSDE) Office of Research and Evaluation (OPER) to assess the computer knowledge of twelfth grade students in California's public high schools.

Microcomputers in Public Schools

Sheingold conducted a study for the National Institute of Education (NIE) in 1983 in an attempt to determine issues and trends relating to the implementation of computer technology in schools. From the study six issues emerged: differential access to computers, emergence of new roles in response to computers, lack of integration of

computers into classrooms and curriculum, inadequate quantity and quality of software, inadequate preparation of teachers for using computers in the classroom, and the lack of knowledge of the effects and outcomes of the instructional use of computers.

She found that there was differential access to computers in school depending on funding. In schools where computers were bought with Federal funds designated for a specific target population, only those identified students had access. When they were purchased by the schools for use in math and science labs, the only access was for the students enrolled in those courses. She also found that active community/ school organizations purchased computers for the classrooms, while schools without community support had fewer, if any, computers. Access to computers, then, depended on the funding of the hardware and software, the program of the school, and the wealth of the commmunity.

She observed in her case studies an emergence of a new role at school sites in response to the presence of computers. Teachers who were interested in and knowledgeable about computers played a central role in spreading the innovation of computer use for educational purposes. They gave personal time without compensation

to teach and encourage others to use computers. She also saw the emergence of student computer buffs who were able to teach the teachers about computers.

Although there was little evidence in her study that showed integration of computers into classroom and curriculum, none of the sites included in her study had intended to change or replace existing curriculum with computers. They were, in all cases, additions to the ongoing curriculum. The computer use either complemented what was going on in the classroom or comprised an additional curriculum in and of itself (i.e., computer literacy, computer programming). Many teachers in her study indicated that classroom use of computers resulted in a more individualized relationship between teacher and student, and less whole group teaching.

The amount and applicability of software varied among schools that Sheingold studied. Some used commercial software, while others used teacher designed programs. One school was able to preview software created by a local company. There was consensus among the teachers at the schools that there was inadequate quality and quantity of software available for educational purposes.

Sheingold found that although at the sites there were inservice courses, opportunities for studies in nearby colleges and universities, and helpful teachers and/or computer resource personnel, these resources were considered inadequate by the teachers. She stated that teachers did not seem to want more or different courses, they wanted more time to use the machines, to review available software, and plan for its use in their classrooms.

From her study, Sheingold deduced that "no one really knows what the educational or developmental consequences of using microcomputers are for children. What teachers report are primarily the social outcomes related to interaction, status and self-esteem."

A nationwide survey made to determine the number and primary uses of microcomputers in the schools was conducted by the Center of Social Organization of Schools at John Hopkins University, under the direction of H. J. Becker, in 1983. The study was based on a probability sample of 2,209 public, private, and parochial schools in the United States. The reported data reflected a weighting of the raw results so that the results were interpreted as a representative sample of all schools in the United States. The

reports generated from the survey were published in six issues of "School Uses of Computers" from April, 1983, to November, 1984, with the focus of each issue on a different aspect of microcomputer use in schools.

The first issue dealt with the number, distribution, and primary uses of microcomputers in the nations' schools. Also reported was how the teachers perceived the impact that computers had on education (Becker, 1983).

According to Becker in January 1983, 53% of all schools in the United States had at least one microcomputer for use in instructing students. Secondary schools dominated the pre-college microcomputer ownership as 85% of all high schools had microcomputers compared to 77% of all junior high schools, and 68% of all elementary schools.

Listing 12 uses of microcomputers for instruction, Becker surveyed schools to determine in what specific ways microcomputers were used. The 12 uses were: Introduction to Computers (Computer Literacy), Drill-and-practice, Programming Instruction, Tutoring, Problem-solving, Games, Simulations, Administrative Uses, Teacher Record Keeping, and Word Processing. Becker found computer literacy was the prime use in

both types of schools, programming was the next preferred use in secondary schools, while drill-and-practice was the most employed use in the elementary schools.

Teachers were asked in Becker's questionnaire whether they regarded the computer as a "tool" to help them teach basic skills or as a "resource" for students to learn more about computers. The responses showed that nearly two-thirds of the secondary schools originally saw the computer as a tool, then after a period of time viewed it as a resource. Nearly one-third of the elementary teachers reported the same after experiencing microcomputer use. Becker offered two inferences from these results: (1) after having tried using computers for programming and drill-and-practice uses, teachers may have found it more useful to employ the machines to expand the curriculum about computers rather than use as another method of teaching traditional subject matter, (2) software available for drill-and-practice was less than satisfactory.

Teachers in Becker's study believed the use of the microcomputer in the schools had a greater impact on the social organization of learning than on increased student achievement per se. They expressed

the belief that computer use "led to increased student enthusiasm for schooling; to students helping one another and answering each other's questions; and to students being assigned to do work more appropriate to their achievement level" (Becker, April, 1983, p.7).

The second issue (June, 1983), on "School Uses of Computers", reported on the numbers of students and teachers using microcomputers in elementary and secondary schools, the number of hours per week that most microcomputers were in use, and the amount of time that each student-user interacted with the machine. Becker stated, "The fact that microcomputers are present in a majority of U.S. schools does not mean that most students are getting exposure to them, nor that they are being intensively used". The researchers found that schools vary a great deal in how much their micros are in use. In secondary schools fewer students get more time, while in elementary schools a greater number of students use the computers but for much less time per week. When the number of micros per student in secondary schools increased, there was an increase in the amount of time for the few student-users, rather than an increase in the number of users. They also found that students

who used the micro for drill-and-practice got only two-thirds as much time at the computer as his fellow student who used the micro to write programs.

Becker made a "reasonably consistent global summary" of how much microcomputers are being used in secondary schools across the nation. He found:

> The typical microcomputer-owning secondary school has approximately five computers, each in use for 13 hours per week, or a total of 65 hours of use. About 80 students (in a student body of 700) use the equipment in an average week--a little more than 45 minutes per user. Progamming and computer literacy activities occupy fully two-thirds of the instructional time on computers. 'Drill-and-practice' activities take up another 18% and the remaining percentage of time is split among 'learning games', various advanced applications such as word processing, science lab work, business courses, and other activites (p. 6, 7).

Becker found that among all secondary schools, senior high schools above 700 students have the highest rate of ownership. The rate is also high nationwide among high SES secondary schools. Low SES

secondary schools and predominately minority schools were least likely to have microcomputers.

In February, 1984, Becker reported that prior to 1982 the initial impetus for obtaining and using micros often came from a single teacher. Later administrators began to play a more active role in obtaining micros for classroom use. In elementary schools, parents played an active role in acquisition of micros, but in secondary schools primarily the administration was responsible.

"At secondary schools, there were fewer differences in reported outcomes according to the involvement of different actors in the acquisition and implementation process. The statistically significant differences that did appear primarily involved two outcomes: individualization of learning tasks and learning by below-average students."

Becker found that in secondary schools where administrators, other than the principal, initiated discussion, obtained the equipment, and organized use of micros, the outcomes previously cited had a significantly higher positive impact. An apparent reason for the differences was that equipment acquired in this manner would be used more frequently

for remediation efforts for students who were performing below grade level expectation. Where an individual teacher was the dominant factor when the school obtained its first equipment, Becker found that the school retained an orientation of serving a narrow student population--the above average achieving student. . . . "leaving acquisition and implementation decisions to an individual teacher, however interested and well-motivated that teacher may be, does more often result in more restricted and less efficacious use," Becker stated.

Factors and Issues Pertaining to
Computer Equity and Accessibility

The focus of this study was on factors and issues that pertained to the acquistion of computer skills in high schools. Issues that were raised centered on equity and accessibility. Moursund, (1984), defined "equity" as an emotion-laden term that conjures up serious problems that need to be addressed individually, institutionally, or politically. He believed that equity in education must be viewed in terms of educational philosophy and goals. The most important of these, according to Moursund, were individual student goals and collective goals. For

the individual, he believed that education should help each student to achieve his/her full potential. For collective goals, education should help support community, regional, national, and worldwide interests. Since computer literacy has become essential, not only for the world of work, but also for successful citizenship and everyday living, the implications were that achieving computer literacy was a worthy goal for all students (Anderson, 1984; Hallworth, 1980; Sheingold, 1982; Walker, 1983). Also implied were corresponding responsibilities of the general public, legislators, and educators to insure that all students had opportunities to obtain computer skills (Anderson, 1984; Lipkin, 1982; Pogrow, 1983). Educational computer inequities threatened to separate groups and communities by allowing access to some people and not others (Anderson, 1984; Lautenberg, 1984; Shane, 1983; Lipkin, 1983; Johnson, 1982). So crucial were the implications and considerations, that the Journal of the International Council for Computers in Education (ICCE) devoted an entire issue to research and discussions of equity.

As discussed earlier, Sheingold addressed the "differential access" to computers. In her study, she

found that while some sites valued equity of access to computers, there were in some instances restrictions on the use of computers by policy or funding. She also found that when the acquisition of computers depended on local initiative there was an unequal distribution of computers among schools, giving some students greater access than others based upon the school they attended. Students who attended schools in poorer communities would have much less access to computers than their more well-to-do counterparts. She added that the literature on educational innovation made clear the community involvement increases the likelihood that an innovation will take hold in a school. Since computer education was clearly a current innovation in education, the community's involvement was an important aspect. Sheingold emphasized that some communities, because of the work life and/or value systems of the adults were more supportive of computers in education than were others.

Sheingold also found that at the secondary level there was differential access based on ability. She observed that students found in high school programming courses were all students who were described as "good

in math", and the only other students with access to computers at the school were those who were educationally disabled.

The literature supported the fact that educators, legislators, and citizens must develop strategies to insure equal opportunities for all students to acquire some measure of competency in computer skills. Policy issues at the local, state, and federal level need to be discussed and resolved if such opportunities were to be considered (Pogrow, 1983).

A Nation at Risk, a report by Commissioner Bell's National Consortium on Excellence in Education, recommended that a fifth "basic", computer literacy, be added to the graduation requirements of English, science, math, and social studies. Legislators were responding to the demand of the citizenry that more be done by government to assure equal access to computer skills. Senator Frank Lautenberg (1984) of New Jersey had a bill before congress called "The Computer Education Assistance Act". The Senator stated "The economic, racial and geographic inequities in access to computers in education are raising concerns among educators and policy makers. The disparities between the 'haves' and the 'have nots' is part of an overall

concern that all children should have these important educational opportunities." Other pending federal legislation is the "Computer Literacy Act of 1983", sponsored by Representative Wirth of Colorado. Senator Helfin (Alabama) introduced a bill that would establish a National Educational Software Corporation to promote the development and distribution of high quality, interactive, and eduationally useful computer software. Pogrow (1983), in a comprehensive analysis of computers in education, outlined additional legislative initiatives on local, state, and federal levels that should be considered if, as a nation, we were committed to providing acquisition of computer skills.

Komoski (1984) asserted that, as a society, we clearly were not providing our students equal access to computers. He cited a National Science Foundation study that found that 31% of the students in affluent urban areas had access to computers as contrasted to only 5% of their counterparts in rural areas. Anderson (1982) reported from a computer literacy assessment that nationwide, smaller communities do not provide as many opportunities for computer education as do larger communities. However, that same year

Market Retrieval Data (1982) claimed that small school districts were beginning to use microcomputers at a rate almost ten times that of the larger school district. The inequity may be in the more remote or rural areas, rather than simply small school ~~districts. Inequity in rural areas was more~~ noteworthy in the incidence of program enrollment, with 17% of the students in suburban high schools enrolling in computer programming and in rural areas only 6% having done so (Anderson, 1984).

Becker (1983) stated that while almost 90% of the nation's high schools have at least one microcomputer, less than 65% of high schools with predominately minority populations and/or low socio economic status (SES) populations had them. Although the acquisition of microcomputers has shown rapid growth, the growth was occurring in schools that already had computers and not in the poorer schools. As a result, the disparity between the rich and poor was widening. The consequence, then, may be an intellectual schism between students in affluent and those in less affluent schools and environments (Alvarado, 1984). The proportion of "have-not" students was growing exponentially (Sturdivant, 1984). Concerned about the

obvious inequity for the disadvantaged, Lipkin (1984) claimed "it reveals an enormous gap between society's commitment to justice and its educational practices. Some schools' successful efforts in computer education highlight the price we pay as a nation by retaining an educational system which permits gross inequities in educational offerings and benefits between rich and poor schools and students." Lipkin believes that computers can and should provide positive reinforcement and, hence, more motivation to learn if the "disadvantaged" were given opportunities to gain mastery of computer skills. He proposed that although, "the disadvantaged have a low level of information processing skills; the computer can serve as the instrument for the development of such skills." Perhaps the single most important fact from Suppes' extensive early work with the Stanford Project in computer assisted instruction was that low ability students gained relatively more than middle and high ability students (Suppes, 1972).

Inequitable access to computer education was a serious educational and societal dilemma. Professional educators and private citizens needed to develop strategies for living, learning and working in an

electronic epoch. No citizens should be denied the opportunities to develop to their fullest potential those skills which appeared to be necessary for functioning effectively in society.

This study was intended to focus on an analysis of factors relating to acquisition of computer skills. By examining evidence empirically revealed in statewide testing by reputable agencies, the researcher attempted to refute or verify the assertions of inequity made in the literature. Using case study methodology, four schools were examined in an effort to determine if issues relating to administrative policies and/or community support may show reasons for dissemblance in test score results.

CHAPTER 3

Described in this chapter are the sample of subjects, the instruments, the method of data collection and the statistical techniques used in the data analysis. The study is comprised of two separate parts. As such, there are two separate samples, two different methods of data acquisition and different methods of data analysis. The first part focused on a statistical analysis of factors relating to the acquisition of computer literacy and computer science skills as measured by tests administered to twelfth grade students in California High Schools. The second part of this chapter describes a case study approach which was used to investigate the history and use of computers at school sites. The case study approach was an attempt to provide a more comprehensive description of school administration and other related factors, such as community values, that might have affected the acquisition of computer skills among twelfth grade students.

Part I

Subjects

From the population of 7,894 high schools in California tested by the State Department of Education

Office of Evaluation and Research (SDE/OPER) a sample of 98 was selected, containing an estimated 23,395 students. Selection criteria were size of school (SIZE) and socio-economic-status (SES) of the parents. (The number of twelfth grade students tested was used as a proxy for SIZE, and parents' educational attainment as a proxy for SES). The schools were ranked in five size categories from the highest SIZE to lowest. Within each of the five size categories, the schools were ranked in five categories by SES from highest to lowest. This resulted in a five by five cross-classification with approximately equal numbers in each cell. Schools were randomly selected from each cell with a probability of p= .125. The sample, according to SDE/OPER, did not differ significantly from the population in terms of achievement or parent education. Eighty-seven schools participated in the study making the response rate 89 percent. Survey questionnaires were received from 17,861 students yielding an estimated student response of 88 percent.

From the SDE/OPER sample of 87, schools with SIZE less than 100 were deleted, since reliability of the results would have been in question due to the nature of the multiple-matrix sampling technique used to test

the students. Thus, a final sample of 63 schools resulted. Tests administered to determine randomness of the sample of 63 schools indicated that random sampling occured in all variables except Parents' educational attainment (SES).

The Instruments

The instruments used to collect data from the twelfth grade students in California schools were the California Assessment Program (CAP), a legally mandated program that assesses achievement in California Public schools. An annual assessment of reading, math and writing skills is made by SDE/OPER. To obtain data about the computer knowledge of twelfth grade students, questions relating to computer literacy and computer science were included on the SDE/OPER annual assessment in the 1982-83 school year. The computer questions were designed by a committee of experts on computer technology from the public school system, universities and industry under the aegis of the Northwest Regional Education Laboratory (NREL) in Portland, Oregon (Fetler, 1983). The questions, based on described instructional objectives for CL and CS curricula (Cardinale, 1982) were used to assess computer education programs in schools operated by the

Department of Defense throughout the world. The instructional objectives were used by NREL to develop 430 questions. Two hundred thirty-nine questions were written for the area of computer literacy and one hundred ninety-one for the area of computer science ~~(see Appendix A)~~.

The tests administered to the students involved multiple-matrix sampling techniques, using a "fixed number of pupil-item confrontations" (Bock, 1982). Use of the multiple-matrix sampling is a reliable, economical method of assessing large school populations; however small populations may not convey an accurate description of the group's capability due to the ratio of responses to the fixed number of pupil-item confrontation. A small population would be considered to be any number less than 100 (Fetler, 1984).

Method of Data Collection

The data used for part one of the study were furnished by the SDE/OPER and were collected by the California Assessment Program for assessing reading, math and writing skills of twelfth grade students. For the 1982-83 school year, CL and CS questions were added to the anual assessment. The statistical

analysis for this study involved a broader and more intense treatment of the data than was done by SDE/OPER. Due to budgetary and time constraints OPER analyzed the data only in terms of percentages.

Statistical Treatment

The more detailed statistical analysis of the SDE/OPER data used in this study included Pearson product-moment correlations, scatter-grams, frequency rations, and stepwise multiple regression procedures. Descriptive data were provided for the following variables in the study: parents' academic achievement, reading, math and writing scores, AFDC percentages, and school Size.

Some of the statistical analysis was done using the Statistical Package for the Social Sciences (SPSS), (Nie, et. al., 1974) on the Burroughs 6700 computer at the University of the Pacific. Also used was the data analysis program "Minitab", developed by the Statistics Department of Penn State University and made available through a Macintosh modem connected to the University of California, Davis, computer systems.

The results of the Pearson product-moment correlations were used to test Hypotheses One, Two, Three and Four. This procedure was used to analyze

the degrees of relationships between the dependent variables--computer literacy and science test scores--and independent variables as stated in the hypotheses.

In an attempt to construct models which could be used to predict CL and CS scores, it was necessary to examine the relationship between the two dependent variables, CL and CS, and the six independent variables. To check the statistical relation between the variables, scatter plots were generated for each independent variable against each dependent variable. While the data produced some plots which were quite spread out about the main axis, all of the plots were elliptical, indicating linearity of each of the random variables. A multiple linear regression was performed using both CL and CS as the dependent variables.

Multiple regression is a statistical technique through which an analysis of the relation between a criterion variable and a set of predictor variables is possible.

Part I of this chapter described the first of two parts of the study. This first part consisted of the description of the universe which was comprised of over 7,000 high schools, the sample which ultimately became 63, and the means by which the sample was

obtained. The research design considered parents' academic achievement, reading, math and writing scores, AFDC percentages and school size as independent variables. Computer Literacy and Computer Science were the dependent variables. Appropriate statistical analyses were made of measures of these variables. The following Part II described the case study methodology used with a sample of four high schools selected by computer matching from the 63 high schools.

Part II

Part II of this chapter described the procedures used in the selection of subjects, the instruments, the method of data collection and the techniques used in analysis of the data for a case study approach. Case study methodology was selected to investigate research questions pertaining to the administration of schools and other related factors, such as community values, which could reveal factors associated with the acquisition of computer skills. Case studies are intensive, independent analyses of particular situations which make use of information from a wide variety of sources to provide a comprehensive description of conditions (Sheingold, 1983). Therefore, the method was ideally suited to the multifaceted, exploratory nature of this investigation.

Subjects

Case studies were conducted at four of the high schools included in the sample in an attempt to find issues and trends that might relate to the acquisition of computer skills and knowledge. By computer matching for the equal or nearly equal socially controlled variables SIZE, AFDC count, and SES schools were indentified from the sample of 63 schools. From that schools. From that delineation, two schools with high

CL and CS scores and two schools with low CL and CS scores were selected to make a sample of four schools.

Instruments

The case study questionnaires and interview guides used for this study were designed and used by ~~Sheingold, et al, from Bank Street College.~~ Sheingold's study sponsored by the National Institute of Education (NIE) in 1981 was "A Study of Issues Related to Implementation of Computer Technology in Schools". The questionnaires and interview guides (Appendix B) revealed the following information about the schools: the goals of the school for computer use, the history of the acquisition and use of computers in the school, the current organization of computer facilities, the issues at the school site promoting and/or inhibiting adequate application of computer technology, and the perceived future prospects of computer use in the school. Separate guides are for administrators, teachers, school trustees, and parents; however, the questions are essentially the same in their scope.

Method of Data Collection

At each school site an interviewer trained in interviewing techniques by the State Department of

Education (SDE) and by the researcher, interviewed teachers, administrators, students, school trustees, and parents. The interviewer was a university graduate who had taught in public and private schools in the United States and also in Germany for the Department of Defense Schools. She had been employed and trained in interviewing techniques as a contract consultant for the SDE to monitor and evaluate State and Federally funded programs in schools throughout the State (School Improvement Programs and Chapter I). She is knowledgeable about computers and has taught courses in computer education.

All the questions centered around the use of computers at the particular school site and also the history of computer use in the school. In addition, the perceptions of those interviewed were sought about the effects of computer use in education and the predictions for the future use of computers in their particular schools.

Demographic data and scholastic ranking information about each school was provided by the SDE. Only information pertinent to this study is included.

Analysis of Data

The case study data were more descriptive than evaluative, as the social and educational milieu of

four schools were depicted. However, since the schools were selected based on high and low CL and CS test scores, inferences were made regarding factors that differ between the two delineations. The data provided a history of the use, number and distribution of computers in the schools and a description of the schools' computer educational programs. From the perspective of Educational Administration, the programs' descriptions provided information pertinent to four general categories: finance, facilities, personnel and organization.

Using Sheingold's research results of the four schools which she studied as a conceptual framework, four of the issues and trends which emerged from her study were used as a comparison to the four schools in this study. The six trends which Sheingold considered as important questions for future research were (a) differential access to computers, (b) the emergence of new roles in response to computer technology, (c) the lack of integration of microcomputers into classrooms and curriculum, (d) the inadequate quantity and quality of software, (e) inadequate preparation of teachers, and (f) lack of knowledge of effects and outcomes.

This study examined for comparison, all but the sixth issue of Sheingold's study. Another dimension discussed in detail in her research was also examined: the level of commitment of the community, administration, and teachers to computer education.

CHAPTER 4

Results

This chapter contains the results of the analyses related to the five hypotheses. A comparative summary of the means of the variables from the 12th grade population of the State of California, the sample from SDE/OPER, and the sample for this study is shown in Table 1. A report on the test for random sampling is included.

TABLE 1

Means of variables relating to computer acquisition skills of 12th grade students

	State Means	SDE/OPER Means	Sample Means
n=	704	83	63
%AFDC	6.7	8.20	9.32
SES	2.89	3.18	3.09
Reading	63.2	63.8	63.2
Math	67.7	68.4	67.5
Writing	63.2	63.8	63.0

%AFDC refers to the percentage of the school population whose family receives Federal subsistence called "Aid to Families with Dependent Children". The

proxy for SES is student reported Parents' Education on a scale of: 5 = Graduate school, 4 = college graduate, 3 = some college, 2 = high school graduate, 1 = did not complete high school. Average scores are reported for Reading, Math, and Writing.

Tests for Random Sampling

To test the data for sampling randomness, the independent variables were tested using the Bonferroni approach (Neter and Wasserman, 1985). Letting all tests together have a significance level of a = 0.10, then each of the six tests will have a significance level a' = a/2(s) where s = 6. That is, a' = 0.10/12 or 0.00833 for each test.

The critical value for rejection of the hypothesis of randomness is:

$$B = t(1 - a';\ n_T - r).$$

where n_T is the number of schools in the sample and r is the number of variables being tested. For this situation, B = t(1 - .00833; 63 - 6) = t(. 9971, 57). Interpolating from a table of the t - distribution in Neter and Wasserman, B = ± 2.4818.

The test statistic is $Y = \frac{X - u}{s/\sqrt{n}}$ where u is the mean of the population.

Table 2 contains the results of this analysis. Nonsignificant results were found for all relationships except for the variable SES (Parents' educational attainment). This indicates that random sampling occurred in all variables except SES. If an overall significance level of a = 0.05 was used instead of 0.01, the critical value, B, would have been 2.8022. Even with this conservative a-level, SES would still exhibit significant nonrandomness (2.8189 >> 2.8022). Hence, the sample of 63 schools did not accurately reflect the mix of parental academic achievement found in the overall population. SES, however, was an important variable because of the social impact as supported by the literature (Luehrmann, 1972; Sheingold, 1982; Becker, 1983). Therefore, it was used as a criterion for the selection of schools for case studies. Conclusions and implications relating to SES are tempered by the nonrandomness. Generalizations based on SES are thus possible only to those areas which have an SES profile similar to those selected in this sample.

TABLE 2

Bonferroni simultaneous significance tests for randomness of sampling. (a = .10, n = 63)

Variables	u	x	s	T	B
AFDC	6.7	9.3175	12.305	1.688	±2.4818
SES	2.89	3.0975	0.5561	2.8189**	±2.4818
RDNG	63.2	63.179	5.5912	-0.0295	±2.4818
MATH	67.7	67.543	6.3399	-0.1949	±2.4818
WRIT	63.2	62.979	5.5591	-0.3130	±2.4818

**indicates significant result

Hypothesis One

Hypothesis One stated there would be no relationship between students' high CL and CS scores and parents' academic attainment. To test this hypothesis a Pearson product-moment correlation was performed. Examination of the product-moment correlation coefficient reveals a significant positive linear correlation between parents' academic achievement and CL and CS scores. The schools with parents with high academic achievement had higher CL scores, with a Pearson product-moment correlation coefficient of 0.6241 accounting for approximately 39%

of the variation. The same schools had higher CS scores with a coefficient of 0.4819 contributing to 23% of the variation. Hypothesis One was rejected with the significance probability for both scores $p < .001$ at three significant digits.

Hypothesis Two stated there would be no relationship between CL and CS scores and reading, math and writing scores. The average scores in all three subjects tested were found to be positively associated with CL and CS scores. Overall, similar coefficients of correlation were found for both CL and CS, as shown in Table 3. However, the CL correlations tended to be slightly higher than the CS correlations. For computer literacy scores, the correlation was highest for math with a correlation coefficient of 0.67. This was followed by reading scores with 0.65 correlation coefficient, and writing with a coefficient of 0.61. The correlations for the computer science scores were highest for reading with a coefficient of 0.58. The math and writing correlation followed with coefficients 0.55 and 0.53 respectively. Hypothesis Two was rejected ($p < .001$).

TABLE 3

Pearson Product-Moment correlations for CL and CS scores with Reading, Math and Writing scores, AFDC, and School Size

	CL scores	p	CS scores	p
Reading	0.65	<.001	0.58	<.001
Math	0.67	<.001	0.55	<.001
Writing	0.61	<.001	0.53	<.001
AFDC	- 0.62	<.001	- 0.48	<.005
School Size	0.17	----	0.20	----

Hypothesis Three stated there would be no relationship between the percentage of AFDC recipients in a school and the CL and CS scores of the schools' students. There is a significant negative linear correlation between the percentage of AFDC recipients within each school and the CS and CL scores. The correlation was somewhat stronger for the CL scores, with $r = -0.62$ and a significance probability of $p < .001$. For the CS scores, however, $r = -0.48$ with $p < .005$. For schools with a higher percentage of disadvantaged students, the CL and CS scores were lower. Hypothesis Three was rejected.

Hypothesis Four stated there would be no relationship between the size of the school and the CL and CS scores of the schools' students. The size of the school does not appear to have a statistically significant correlation. The CL scores, with $r = 0.17$, did not reach statistical significance. CS scores have a correlation coefficient of 0.20 which does not reach statistical significance. At a test size of $a = 0.10$, Hypothesis Four was accepted, since statistical analysis indicated there was no significant relation between size of school and CL and CS scores.

The preceding linear correlations were verified using scatter plots. All plots exhibited either circular (small correlation) or elliptical (large correlation) patterns with the heaviest density of points around the mean of the samples. No aberrant patterns were found.

Table 4 reports the results of the stepwise regression which was used to determine the relationship among the predictor variables: reading, math, writing, AFDC percentage, PAR, ADA, and the dependent CL and CS scores. A significant relationship ($R = 0.580$) between computer science and

reading scores was found. Approximately 33.66% of the variation in computer science scores could be accounted for by knowing a student's reading scores. The remaining five predictors did not make a significant contribution to explain further variation in computer science.

A significant relationship between computer literacy and math scores was also found using stepwise regression (R = 0.672). Approximately 45.14% of the variation in computer literacy could be accounted for by knowing students' math scores. Again, the five remaining predictor variables did not contribute significantly to explaining variation in computer literacy scores.

Other variables not considered in this study appear to account for over half of the variations in computer literacy and computer science scores. It would, therefore, be important to examine additional variables which might significantly relate to CL/CS scores.

TABLE 4

Summary of Stepwise Regression Analysis of Computer Literacy and Computer Science Scores (N = 63) (outlier included and transformed AFDC)

Dependent Variable	Step	Predictor Variable	Multiple R	R^2	T
Computer Science	1	Reading	0.580	0.3366	5.56*
Computer Literacy	1	Math	0.672	0.4514	7.09*

* $p < 0.01$

Table 4 shows a summary of stepwise regression analysis of computer literacy and computer science scores. The data analysis program "Minitab", developed by the Statistics Department of Penn State University and used for the stepwise regression analysis, does not print those predictors that do not make a significant contribution to explain variation in scores.

Part II

Introduction

Part II of this chapter analyzes information gathered from four California High Schools selected for in-depth case studies. These schools were ~~selected from the sample of 63 schools studied in~~ Part I. The schools were selected to be representative of schools where pupils scored high or low on computer literacy (CL) and computer science (CS) assessments given by the California State Department of Education (SDE). Two of the schools had high scores on computer skills tests and two had low scores. Further matching was done on two socially controlled variables. From a computer generated list, the researcher identified schools in which the socially conrolled variables, size of school and educational attainment of students' parents were similar. The case studies were done in an attempt to determine what other factors not revealed in Part I might have been responsible for the differences in scores on CL and CS tests. Personal interviews at the school site of community members, school administrators, teachers and students were conducted during the Spring of 1985. Other pertinent information

was obtained from the California State Department of Education/Consolidated Programs Description Database (SDE/CPDD-3, 11/84).

An Overview of Four Schools

Criteria for the selection of the four schools for the case study included: two schools with high and two with low mean scores for CL and CS, parents' educational attainment (SES), the size of school (as measured by the number of 12th graders taking the state-mandated CAP test), and reasonable proximity of sites to one another and to the researcher.

Table 5 presents a summary of the means, standard deviations, and ranges of the variables Size, SES, and AFDC percentages, and the mean scores for CL and CS. The number of 12th grade students tested by the State mandated testing program, CAP, was the proxy used for Size. The sample mean for Size was 311, with a standard deviation of 131.7, and a range of 572, from a minimum 101 to a maximum 673.

The sample mean for SES was 3.09 with a standard deviation of 0.6. The range for SES was 2.19 with a minimum 2.07 and a maximum 4.26.

TABLE 5

Summary of Means, Standard Deviations, and Ranges of Variables for Sample (n = 63)

Variable	Mean	sd	Range	Min	Max
Size	311	131.7	572	101	673
SES	3.09	0.6	2.19	2.07	4.26
AFDC%	9.32	12.31	88.4	0	88.4
CL/CS mean	38.2	3.02	17.6	27.9	45.5

The mean score for the AFDC percentage for the sample (n = 63) was 9.32 with a standard deviation of 12.31, and a range from 0% to 88.4%. The mean CL/CS score for the sample was 38.4 with a standard deviation of 3.02. The range of scores was 17.60, from 27.9 to 45.5.

Table 6 shows the criteria for school choices, the sample mean (n = 63), and the corresponding values of each school in the case study sample. The SES score was obtained by students' reports of the amount of education their parents had. A score of 1 equaled "did not complete high school", 2 was "high school graduate", 3 meant "some college", 4 stood for "college graduate" and 5 represented "graduate school". The criterion

for SES was less than 3.5, while criteria for the Size of schools were greater that 200 students and less than 325 students. The criteria for CL/CS scores were greater than 39 and less than 35.

TABLE 6

Criteria for Choice of Schools for

Case Study Methodology (n = 4)

Variable	Criteria	(n = 63)	Hi1	Hi2	Lo1	Lo2
SES	< 3.5	3.1	3.5	3.2	2.5	2.6
Size	> 200 < 325	311	284	245	277	250
CL/CS	> 39 < 35	38.4	42.3	39.1	31.7	34.6

Table 7 shows a summary of means, standard deviations and ranges for the sample of four schools. The variable Size had a sample mean of 266 with a standard deviation of 66. The range of Size scores was 39, from 245 to 284. The mean for SES was 2.95 with a standard deviation of 0.7, and a range of 1.0 with a minimum of 2.5 and a maximum of 3.5. The CL/CS mean scores were 36.9 with a range of 10.6, with the minimum score 31.7 and the maximum score 42.3. Since these scores were selected as two high and two low, no standard deviation was calculated. As indicated by reference to Table 5 all mean values of the selected

schools shown in Table 7 were within one standard deviation of the 63 schools in the sample.

TABLE 7

Summary of Means, Standard Deviations, and Ranges for Four Schools in Case Study (n = 4)

Variables	Mean	sd	Range	Min.	Max.
Size	266	66	39	245	284
SES	2.95	0.7	1.0	2.5	3.5
CL/CS Score	36.9		10.6	31.7	42.3

Another criterion considered for school selection for the sake of expedience and cost was the proximity of schools to one another and to the researcher. All four schools were within a forty mile radius of the most centrally located, within a hundred mile radius of the researcher, and in the San Francisco Bay Area.

Additional data about the four schools were obtained from the "Curriculum Profile", a document fron the SDE/Consolidated Programs Description Database (CPDD) (See Appendix C). The "Curriculum Profile" provided specific information about each school which was not available from the SDE/OPER data nor obvious to the researcher at the site. The information described the kind of community, the

ethnicity of the 12th grade, and course enrollment data from each school. The data were collected by SDE during the 1981-82, 1982-83, and the 1983-84 school years, with a specific topic addressed each year. The population for the data, although from the same school was not the same group of students, but rather students from the previous 12th grade class or the succeeding one. CL/CS data were from the 12th grade students in 1982-83, and student ethnicity from the 12th grade students in 1981-82. Course enrollment data were from the 1982-83 12th grade students, while the information pertaining to the number of years completed in each discipline was obtained from the school in 1983-84. The SDE compiles information about schools and reports on a single fact sheet called "The School Profile". The data are reported here to give the reader additional information about each individual school in the sample of 4 schools. According to SDE/CPDD High 1, High 2 and Low 2 schools' communities were described as suburban. Low 1 school's community was identified as "small city". Table 8 shows the percentage of White, Black, Hispanic, Asian and American Indians in each school. The profile of each school is quite different. Although neither ethnicity nor number of minority

students was an issue in the research, the data are shown to add more dimension to the school site picture.

TABLE 8

Student Ethnicity of the 12th grade students (in percentages) for the 1981-82 School Year (n = 4)

	HIGH 1	HIGH 2	LOW 1	LOW 2
WHITE	87.9	70.4	79.2	24.6
BLACK	0.3	16.7	0	10.4
HISPANIC	9.4	7.2	20.8	33.3
FILIPINO	0	0.8	0	14.8
ASIAN/PAC. ISL.	2.4	3.4	0	15.3
AMERICAN IND.	0	1.5	0	1.6

Table 9 shows course enrollment data for the 1982-83 school year as reported in the annual California Basic Enrollment Data Survey (CBEDS) included in the SDE/CPDD school profile. High 1 and High 2 schools show a larger percentage of students in literature and writing courses, while the two low schools had a larger percentage of students enrolled in Reading Development/Improvement (remedial reading) and English as a Second Language (ESL).

For enrollment in math courses, only High 1 appears different from the other three with 35% of the students enrolled in advanced math. There was no evidence of Computer Education courses in Low 1 and Low 2 Schools reported in CBEDS nor observed at the site by the researcher.

TBLE 9

CBEDS Course Enrollment Data for 1982-83 shows percent of student body enrolled in courses (n =4)

	HIGH 1	HIGH 2	LOW 1	LOW 2
RDNG DEV/IMPRVMT	0	2	15	11
LITERATURE	12	7	0	0
WRITING	0	14	0	0
ENGL.SEC.LNG.	2	0	5	12
GENERAL MATH	6	20	35	5
ALGEBRA/GEOMETRY	22	27	26	18
ADVANCED MATH	35	8	10	14
COMPUTER EDUCATION	4	6	0	0

Table 10 reports on the percentage of 12th graders at each of the four schools who completed at least four years of English and social studies, three years each of science, math, and foreign language and

one year of fine arts. The data were obtained from CAP and reported in School Profile SDE/CPDD-3 (11/84).

TABLE 10

Six High School Disciplines and the Percentage of Students Who Completed a Certain Number of Years of Each (n = 4)

	Percent of 12th graders who completed at least:			
	HIGH 1	HIGH 2	LOW 1	LOW 2
4 years English	94	71	57	83
3 years Math	64	61	54	85
3 years Science	28	30	26	40
4 years Soc. Stds.	23	38	09	62
3 years For. Lang	35	24	11	17
1 year Fine Arts	54	94	67	55

An important variable to be included in a study of such capital-intensive items as computers is variation in fiscal resources. However, such data are uniformly reported only on a district by district basis, and there is no easy way to identify the allocation of resources to an individual school within a district even when there is only one high school. Meaningful comparisons cannot be made by multiplying

the revenue limits by the number of 12th grade students and comparing the amounts of money available to purchase services and programs. Decisions about which schools get how much money are typically made at the local school board level and reflect a variety of local concerns. The information is added in this study only to give another dimension to the profile of each school.

Table 11 presents the total revenue limits per ADA for the four-school sample. The total revenue limits per ADA was reported in Annual Financial Reports of the State Department of Education.

TABLE 11

Total Revenue Limits Per ADA, 1982-83 (n = 4)

School	HIGH 1	HIGH 2	LOW 1	LOW 2
Revenue Limit	2,386	1,935	2,156	2,506

A Description of the Schools

Each of the four schools is described separately, beginning with the school selected with a low CL/CS score and ending with the school with the highest CL/CS score in the sample (n = 4). The schools will be referred to as Low 2, Low 1, High 2, and High 1.

The data were obtained by interviews of school personnel and community members in the District. Additional information was supplied by the California State Department of Education.

The conceptual framework for the study was derived from the Bank Street College Study (Sheingold 1982), in which different structural levels defined the context for the implementation and impact of computers in the school. The structural levels included the communities, school districts, schools, teachers and students. The community context was investigated because in some communities the occupation and/or value system of the adults were more supportive of computers in education than were others (Sheingold 1983). The school districts' financial support of computers in the schools was explored to determine the level of commitment from the administration. For the sake of brevity, these conceptual frameworks were reported under the headings of: Role of Community and District, History of Computers in the School, and The Use of Computers in the School. For purposes of analysis within the stated context of Educational Administration, the four delineations: Finance, Personnel, Facilities and

Organization were used as a format, after the six trends found in a Sheingold study are addressed for a comparison study.

School Low 2

School Low 2 is located in a suburban community in a close proximity to a major city. The school had a relatively high proportion of minority students (Table 8). The total revenue limit for the district for the 1982-83 school year was $2,506, the highest of the sample of four schools (Table 11). The size of the 12th grade class (Size) in 1982-83 was 250. The SES score was 2.6 (Table 6). Interviewed for this study were the principal, a project coordinator, and teachers.

Role of the Community and the School District

There were no individuals from the community, local education agencies, public or private institutions, or businesses that offered assistance in setting up a computer education program in the school. The extent of community involvement in Low 2 school appeared to be the few parents who were on the Parent Advisory Committee (PAC) for the Chapter I program at the school.

The school principal reported that the District allocated $25,000 for computer hardware and software for the four high schools in the District, but Low 2 did not receive any of the allocation. The funds were used to set up computer labs in two other schools in the District.

School Low 2 is located in San Mateo County, where the County Office of Education was selected by the State to house the library for all the TECC (Teacher Education Computer Center) educational software for the entire State. School Low 2 does not appear to have benefited from the proximity to the TECC library.

History of Computers in the School

Those interviewed at the school site reported that there was very little community involvement at the school. The involvement was especially limited in the acquisition of computer hardware or software. The science and math teachers at the school reported that they had organized committees and written proposals for a computer program, but their efforts were not recognized by the District.

The science teacher stated that although he had a degree in educational technology, his expertise was

not being utilized by the school. He claimed that he was unable to get cooperation for developing a computer program from the school administration or the district administration.

A decision was made in 1980 to use the schools' Chapter I funds to purchase computers for remedial use. Chapter I is a federally funded program with the prime purpose of reinforcing or remediating basic skills for an identified portion of the schools' population (usually those students scoring below the 25th percentile in math, reading and/or language on a standardized test).

The school principal reported that there was an early effort to train teachers to use computers in their classrooms by having them attend a workshop in word processing for the TRS-80 computers. Approximately 90% of the teachers participated in the workshop. Later, sixty percent of the schools' teachers went to a computer software fair. Since educational software for the TRS-80 computer was limited and the availability of the computers was restricted for use by identified Chapter I recipients, the results of the training were not productive for the entire school.

Use of Computers in the School

With the Chapter I funds, sixteen TRS-80 computers were purchased, but they were necessarily restricted by Federal requlation, for use only by identified Chapter I students. The primary uses were for remedial Computer-Assisted-Instruction (CAI) and for individualized lessons generated on the word processor by teachers for Chapter I students.

The Special Education Program had two computers, a TRS-80 and an Apple II-E. The computers were used for remedial purposes with CAI and tutorial programs for the Special Education students. (Special Education is funded mainly by the State).

The business department at the high school used vocational educational monies which are Federal and State allocations, to purchase TRS-80 computers and place them in a lab setting. They were used by the business students for keyboarding skills and word processing.

None of the teachers at the school were using the computers on a regular basis for teaching students with the exception of the special programs teachers, Chapter I, Special Education, and Business Education. The computers in these departments were used for CAI, keyboard skills, and word processing only. No CL or CS courses were offered (Table 9).

There were computers in the faculty room which were being used by the teachers to type their lesson plans and to record grades. The counseling department had an Apple II-E which was used to score proficiency tests, process transcripts, and analyze data relevant to the district's stated competency requirements. The other computer in the school was an Apple II-E used in the office for administrative tasks, such as attendance and students records.

Computerized systems were used extensively by the attendance office to communicate with the home via phone dispatches in many languages. The system reports to the parents in the home language about the students' absence and tardiness.

School Low 1

School Low 1 is located in a community described by the SDE/CPDD as a small city. It is described by local residents as a bedroom community for the neighboring industrial cities. The community is in a transitional stage from an agriculturally based community to a bedroom community. The ethnic mix is about 80% white and 20% Hispanic (Table 8). The revenue limit for the district is $2,156 (Table 11). The number of 12th grade students in 1982-83 was 277

(see Table 6). The parental educational attainment mean was 2.5, the lowest SES in the sample of four schools. The principal, the director of curriculum, 2 teachers, a parent and former school trustees were interviewed at Low 1 School.

Role of Community and School District

Those interviewed at the school reported that there was not much community participation in school program development, with the exception of the school site council's decision to purchase computers with School Improvement Program (SIP) funds. The membership of the school site council, by law, requires parity in parents of program recipients and school personnel; therefore, there was some parental affirmation to use funds to purchase computers.

History of Computers in the School

The first computers were purchased by SIP funds when a needs assessment revealed that school improvement funds were needed to focus on the slow learner, the bilingual and the gifted.

They decided that computer education programs could meet those needs with CAI and tutorial programs. A committee of interested teachers and administrators met and attempted to design a computer education

program. They reviewed available software for a program and then considered appropriate hardware. They hired a consultant to assess the plan and to assist in developing a long range plan.

Computers were purchased with SIP, Chapter I, and Vocational Education funds. The SIP funds were used to purchase 3 computers for a lab setting and 4 were purchased by Chapter I, Special Education and Vocational Education.

Original computer purchases using district funds were utilized primarily for administration purposes. There was little evidence from the interviews of any community participation or involvement in the computer education program. Nor was there evidence of a commitment from the administration to teacher training and staff development. The only teacher involved in teaching with computers was self taught. The teachers interviewed stated that there was a lack of direction from administration for implementation of a computer program.

Use of Computers in the School

Three computers purchased by SIP funds were used in a lab setting for math and English skill reinforcement. The computers purchased by Chapter I

and Special Education were used for CAI and tutorial programs for remediation. The computer in the Agriculture program (Vocational Education) was used for statistics related to the amount of feed use and weight gain for the livestock. Teachers used computers for classroom management, attendance records and grades. Counselors have computer terminals at each desk and have a highly sophisticated counseling set-up. Library resources are computerized.

Although it was not possible to get an accurate account of the number and use of computers in each school, at the time of the site visitation there were reported to be approximately 40 computers throughout School Low 1. Most of the computers, however, with the exception of those purchased for categorical programs, seemed to be used for administrative and other purposes rather than for students' use.

A recently appointed director of curriculum reported that the community has become more involved this past year. The changing population in the community, according to a parent interviewed, is bringing about changes in school policies about computers in education, because their students are coming from other districts with sophisticated

computer skills. The school had recently hired a consultant to develop a long-range plan which included teacher training and staff development and the use of computers in all curricular areas.

School High 2.

The community in which School High 2 is located is classified as suburban by the SDE/CPDD. It is the site of several large, light industrial plants and thus would be expected to have a sizable "blue collar" population as well as serving a commuting population. The district revenue limit for the 1982-83 school year was $1,935, the lowest of the sample of four schools (Table 11).

The SES for the school is 3.2 which is within one standard deviation of the sample mean (= 3.09, = 0.6). The number of 12th grade students tested was 245 (Table 6). Thirty percent of the population were minority students with every one of the five listed minority groups represented (Table 8).

The principal, the librarian (who is also the computer committee chair), 2 teachers and a student were interviewed at the school site. They were enthusiastic about the use of computers and proud of the progress made at the high school.

Role of the Community and the District

Representatives of the school, community, local agencies, businesses and industry were included in the initial stages of the computer plan development in 1982. The planning committee contacted and consulted with the County TEC Center, Computer Users for Education (CUE), Heald School of Technology, two industries (Quantel and Advanced Data Processing), and Betamax and other publishers. They also consulted parents, teachers, students, and administrators. The goal of the committee was to develop a district plan for the use of computers in the school.

District financial support was provided for the purchase of computer hardware and software for the high school business education department, home economiscs department and for establishing a computer lab. A computer was donated by the senior graduating class as a class gift, and another was purchased with student body funds. Eight additional computers were available to High 2 through the district library.

When a junior high school in the district that housed an Adult Education Program was closed, the 20 computers from the computer lab were moved to High 2. The high school students had use of the computers

during the school day, and they were used by the Adult Education classes in the evenings.

Quantel Corporation donated a computer and two terminals to this high school. The corporation also invited a teacher to attend the Quantel Computer School for two weeks.

History of Computers in the School

A computer committee was established in 1982 to develop a district level computer plan. The computer study committee was composed of administrators, librarians, parents, and teachers from all curriculum areas and grade levels. The committee, the county TEC center specialist, and community representatives met 22 times. They studied and observed 6 districts programs, attended 9 conferences, visited hardware and software vendors, attended computer expositions, surveyed the community and district personnel, and developed a plan which was adopted by the school trustee.

Use of Computers in the School

All students had an opportunity to sign up for computer literacy and computer programming courses as elective courses which were offered six periods each day. The ability level for computer use was a

consideration for each grade level as well as for the special programs such as Gifted and Talented Education (GATE) and Special Education.

Computers were used in home economics, business education, language arts, science, math, computer literacy and computer science courses. The emphasis in the school was the use of computers in all curricular areas and the use of the latest technology in instructional materials.

In addition to the six periods a day, there was a "before school" and "after school" program offered to the students. To maintain a fund for the purchase of software, a fee of twenty-five cents was charged for computer use at times other than class time. The high school loaned the computers to the students and teachers to use on weekends and during school vacations. The principal said that about 20% to 30% of the students had their own computers at home.

School High One

School High 1 is located near the heart of the "Silicon Valley". Within the limits set by the school selection criteria, High school 1 had the highest values of parent educational attainment, size and CL/CS scores. Reference to Tables 9 and 10 indicates

that High 1 differs from the other schools in the study in the percentage of the student body enrolled in advanced math and the percentage of 12th graders completing 4 years of English.

The revenue limit for the District for the 1982-83 shool year was $2,386, the second highest in the sample of four schools, exceeded only by Low 2 school.

At High 1 those interviewed included the vice principal, the administrative assistant, a school board member, an English and math teacher, the president of the PTA and a student. The board member was an alumnus of the high school.

Role of Community and District

The school board member reported to the researcher that in 1978 the community applied pressure and "impatient pleas" for the high school to become computer literate. Several parents from the community worked for Hewlett Packard and IBM. Due to their efforts the school received 20 HP computers and 20 IBM computers. The distict was very receptive to a computer education program in the school. The school board was supportive of the districts' efforts to establish and maintain a good computer education

program. The interviewed member felt that computers were vehicles to teach all disciplines.

The teachers stated that there was excellent guidance and direction from the administration. They had good management, planning, focus, direction, and critical evaluation throughout the implementation of the computer education plan. There was total commitment from the staff, at all levels, to work with computers to improve this school educational program.

History of Computers in the Schools

The board member reported that computers had a long history in the high school. Having been a student in the district in 1970 when the school had Wang computers, he recalled that the students were able to work with the computer system using the IBM cards. Digital Equipment Corporation set up an educational unit at the school in 1970 which was a joint effort on the part of the school, the community, and business. By the time of the CL/CS testing in the 1982-83 school year, this high school had a 12 year history of computer use by students.

In 1978, the math, science and English teachers wrote a Title IV-C grant application for a CAI Science/Math and English program. Title IV-C was a

federal program that provided funds to purchase library books and audio visual materials. The school received $30,000 in funds from the Federal grant for a three year period, 1978-81. In 1981 the school received a two year extension, received more funds and continued to build the computer education program. The district matched the federal funds.

With the help of the federal funding, the teachers were able to attend conferences and consortia. The principal stated that the teachers had been consistently enthusiastic about the use of computers and welcomed the opportunity for training in the use of computers for all disciplines.

The Use of Computers in the School

The vice-principal said that they viewed the computer as a device to help instruction, through Computer Assisted Instruction (CAI), Computer Managed Instruction (CMI), and Computer Vocational Instruction (CVI). All computer use in education crossed these lines, he claimed.

The first goal of the high school was to prepare students for a world where computers play an increasingly important role. The second goal was to make a continued effort to use computers and related

technology to improve the educational program for all students in all grades.

At High 1, most major departments had computers in the classroom. Computer labs were set up in the math, science, and business departments, and in a career center in the library. CL and CS courses were scheduled every period to insure access to computer elective courses for all students. The students operated their own computer based school banking system in addition to the constant use of computers for educational purposes.

Throughout the school day, the district hired an instructional aide to maintain labs for students' use before and after school hours. Computers are also used throughout the school for administrative purposes.

Summary

The data from the four schools were contrasted and compared in terms of Finance, Facility, and Program. Finance, which in this study pertained to 1.) the relative wealth of the district in terms of revenue limits and 2.) the financial source for the purchase of computer hardware and software. Personnel included the number and position of staff management

involved in the computer education program at the school site. Facility was used in the context of this study to define the location of the computers in the school, and compared the accessibility of computers in the four schools. The term Program referred to the planned acquisition and use of computers at the school site.

Finance

The case study interviews revealed that at the two schools that had low CL/CS scores, no district monies were used specifically for a computer education program. At both schools the computers for student use were purchased with categorical funds which is money from federal and state sources designated for use only in specific programs for a restricted group of students. In the case of both Low 1 and Low 2 schools, the categorical programs included Chapter I, Special Education, and Vocational Education. School Low 1 purchased some hardware and software with School Improvement Program (SIP) funds which would have allowed use by all students; however, the number of computers that Low 1 was able to purchase with SIP funds was limited.

The revenue limits for the districts in which Low 1 and Low 2 schools were located were $2,156 and $2,506 per ADA, respectively. The amount for the Low 2 school was the highest amount in the sample of four school districts.

At High 1 and High 2 schools, district funds were budgeted for the purchase of computer hardware and software for computer programs. The district matched funds for a special grant at High 2. In addition to the commitment of the district to a computer program, the community was instrumental in getting sizeable donations of hardware, software and staff inservice training from industry.

The total revenue limits for the district in which High 1 was located were $2,386 per ADA. This amount was the second highest for the districts from which the sample of four schools was drawn exceeded only, by Low 2. The total revenue limits for the district where High 2 is located were $1,935 per ADA, the lowest amount of the sample.

On the basis of this small sample, relative revenue limits are not major determinants of high CL/CS scores. Factors such as community involvement and commitment on the part of district administration

are more critical than relative "wealth", as measured by revenue limits for ADA. The complexities of school finance are beyond the scope of this study, yet the explanation offered here appeared generally sound.

Personnel

At schools Low 1 and Low 2 the personnel involved in computer use were those teachers who taught in the Special Programs, such as Chapter I, Special Education, and Vocational Education. Other computer users at the school sites were secretaries, counselors, attendance clerks, and others involved in the administration of the schools. Teachers at one school had a computer in the staff room for their own personal use.

Computers were used throughout the High 1 and High 2 schools for administrative purposes. At High 2 school computers were integrated into the curriculum and used by teachers and students in home economics, business, language arts, science and math. They were used also for remedial purposes in special education classes. In addition, computers in a lab setting were used six periods a day by all students who elected CL and CS classes and were used under supervision before and after school.

School High 1 had a long history of computer use. The computers were used in many classrooms as well as in three labs in different departments and locations. Teachers were trained, not only by district in-service training but also by local industry. Both CL and CS classes were offered to students as electives and a before and after school program was provided by the district.

Facility

As described above, the facility provided for computer use in Low 1 and 2 schools was necessarily in resource rooms for special categorical programs, and not available for all students. At High 1 and 2, schools computers were in all departments as well as in separate labs to facilitate access to all students who elected to use them.

Program

There were no obvious signs of a comprehensive program involving administration, teachers and community in either Low 1 or 2 school that would benefit all students. The only organizational structure with a specified purpose was for an identified group of students in categorical programs.

In schools High 1 and 2, organization was obvious, and programs were implemented to benefit all students in the school.

Summary, Discussion and Conclusions, Recommendations

This chapter contains a summary of the study, followed by discussion and conclusions. The final part of this chapter contains recommendations for further research. Discussion of the research is based on findings but is subject to limitations cited earlier.

Summary

This study was an investigation of factors relating to the acquisition of computer skills by 12th grade students in California high schools. Evidence contained in statewide testing by state agencies was examined to determine predictive variables that may refute or verify the assertions made in the literature about inequity in the acquisition of CL/CS skills. In addition, case study methodology was used to examine four schools from the sample of 63 schools in an attempt to determine if issues relating to administrative policies and/or community support affect students' acquisition of computer skills.

A review of relevant research indicated that educational computer inequities threatened to separate groups and communities by allowing access to computers

to some people and not to others. The literature also suggested that some schools' successful efforts in computer education made emphatic that our educational system permits inequities in educational offerings and benefits to rich and poor schools and students. The consequence may be an intellectual schism between students in affluent and those in less affluent schools and environments.

Since the study was comprised of two parts, the instruments used to collect data were different for each part. In the first part of the study the California Assessment Program (CAP) tests were used. For the second part, the case study interview guides used by Bank Street College for a related study under the sponsorship of The National Institute of Education (NIE), were used to obtain information from the four selected schools. Other pertinent information was obtained from the records of the California State Department of Education.

The subjects of the first part of the study were 63 high schools in California, selected from a population of 7,894 schools tested by the California Assessment Program for computer literacy and computer science skills. The subjects for the second part of

the study were four schools selected for in-depth case studies from the sample of 63 high schools.

Pearson product-moment correlations were used to test Hypotheses One, Two, Three and Four. Hypothesis Five was eliminated from the study due to lack of empirical data. A stepwise multiple regression was used to determine appropriate variables that were used to predict students' CL and CS scores. The .005 and .001 levels of confidence were used to determine statistical significance.

Following are the null hypotheses of the study and a designation of rejection or acceptance:

Hypotheses One stated that there would be no relationship between students' high CL and CS scores and parents' academic attainment. This hypothesis was rejected.

Hypothesis Two stated that there would be no relationship between CL and CS scores and reading, math, and writing scores. This hypothesis was rejected.

Hypothesis Three stated that there would be no relationship between the percentage of AFDC recipients in a school and the CL and CS scores of the schools' students. This hypothesis was rejected.

Hypothesis Four stated there would be no relationship between the size of the school and the CL and CS scores of the schools' students. This Hypothesis was accepted.

The results of the stepwise regression used to determine the relationship among predictor variables, showed a significant relationship between computer literacy and math scores wherein approximately 34% of the variation in computer literacy could be accounted for by knowing students' math scores. Computer science, on the other hand, was shown by the results of the stepwise regression to have a significant relationship with reading scores. Approximately 34% of the variation in computer science scores could be accounted for by knowing a student's reading score.

Discussion and Conlusions

Significant relationships were found between the students' high scores on CL and CS tests and the reported educational attainment of the students' parents. High AFDC percentages showed a negative correlation with CL/CS scores. Since higher educational attainment of parents and a low percentage of AFDC count at a school would be equated with more affluence, these findings concur with Becker's nationwide research that has shown that although the

acquisition of computers had shown rapid growth, the growth was occurring in schools that already had computers, not in poorer schools, and the disparity between the rich and the poor has widened. The findings support Lipkin's claim that as a nation we retain an educational system which permits gross inequities in education offerings and benefits between rich and poor schools and students.

Significant relationships were found between mean scores on reading and math and CL/CS scores. This important finding has implications for social policy. The literature, including A Nation At Risk and the California model graduation requirements, refer to the need for a computer literate citizenry. The achievement of those goals cannot be done in curricular isolation; students must possess sufficient skills in reading and math before they can undertake computer courses with reasonable chances for successful acquisition of skills. In addition to the implications for further research, these findings have important implications for educational administration with respect to "readiness" for CL/CS courses.

The case study research showed that High 1 school had 35% of the students in advanced math, while schools Low 1 and Low 2 had fewer than 15%. Schools

High 1 and 2 had students enrolled in literature, while the low school had students enrolled in Reading Development/Improvement and English as a Second Language. This lends support to the findings of Sheingold that reported differential access to computers based on ability, with programming courses for those good in math and the remedial use for those students who were learning disabled. It can be concluded that the limited access in Low 1 and Low 2 schools to the computers purchased by government funds would not prepare students to be knowledgeable about CL and CS, whereas the higher percentage of students in High 1 and High 2 schools have computer labs in advanced math, writing and literature courses.

The early research in 1967 by Suppes gave evidence that CAI in mathematics was academically beneficial for students and that computerized drill-and-practice programs produced impressive results in school environments not economically and educationally affluent. Atkinson's research in language arts and reading, also in the late sixties, was tutorial in nature and had shown positive results also. Visonhaler and Bass stated in 1972 that the controlled studies in language arts and mathematics gave strong evidence of their effectiveness as measured on

standardized tests. There was no inference in this study that the use of computers in special programs was without merit. There are suggestions, however, that the use of computers for this reason alone was depriving the other students who are not identified program participants, the experience with computers in an academic setting. The limited use of computers for CAI and tutorial programs also deprived the program participants from CL and CS courses. There was cause to believe that the long history of computer use by High 1 and High 2 schools which would have included CAI and tutorial programs were favorable factors that allowed the schools to have greater participation in advanced courses in math, reading, and writing, as well as CL and CS.

There was evidence in this study of the emergence of new roles in response to computers in educational settings as there was in Sheingold's study. The teachers from three different disciplines in High 2 school took leadership roles, combined their talents, and wrote a grant that brought $30,000 to the school for the benefit of all teachers and students. The parents at Low 2 school are reportedly becoming more assertive about computers in the school, so there was

evidence of an emergence of a new role in parent participation due to computers.

In this study and in Sheingold's, the lack of integration of computers into curriculum was evident. It must be noted though that Sheingold's subjects were elementary schools whereas this study's subjects were secondary schools. The lack of integration was evident in the two low scoring CL and CS schools which used computers only in special programs that had specific purposes, with the exception of some integration with the business and vocational education program. In the high scoring CL and CS schools, however, the computers were very much in evidence as an integral part of the curriculum in almost all subject areas.

Another trend that Sheingold addressed in her study was the inadequate quantity and quality of software. The respondents in this study did not answer negatively to the question about the amount and quality of software. The two low schools had CAI instructional materials for their programs and Schools High 1 and 2 had adequate funds to purchase quality software, and the well trained instructors and students at High 1 school were writing their own computer programs to suit the curriculum.

Similar circumstances prevailed with the issue of inadequate preparation of teachers. The two high scoring schools had ample resources for the teacher training in local industry, district funding, grant money, and enthusiasm of teachers to be trained, whereas the two low schools had none of these resources or attributes. This supports Sheingold's findings to the extent that an adequate amount of teacher preparation and training was required for a successful computer education program.

The analysis of the information obtained by case study methodology showed strong evidence that the level of commitment of the community, administration, and teachers to computer education was a determining factor in the success of the program. The financial commitment, teachers' willingness for training, the administrative concerns for integrating the computers into curriculum, and the provision of equal access to the computers, were all present in the schools that had high CL and CS scores.

Recommendations

The purpose of this study was to identify relationships among dependent variables, acquired knowledge of computer literacy and computer science, and independent variables that pertain to public

schools. The independent variables were reading, math and writing scores, size of school, parents' educational attainment, and percentage of AFDC recipients in the school. Analysis of the data indicated that relations among the specified variables did exist. Further investigations of these variables could make a stronger assertion that the results are valid. As a consequence, the following recommendations are made:

1. School Districts and educational administrators should make financial commitments to computer education programs with adequate funds budgeted for hardware, quality software, and teacher training. They should also have available competent and well-trained personnel to teach and supervise computer courses and computer labs. Facilities for housing computers in labs or classrooms should assure equitable access to the use of the computers for all students. Programs for computer education should be designed with input from experts in the field, teachers, administrators, parents and students. As shown in the results of this study, the involvement of the community is an important part of a good school program. It would be strongly recommended that this factor be a major consideration.

Further recommendations for administrators are that students who have difficulty in reading and math should receive extra help with computer assistance and teacher guidance and that the same students also have the opportunity to use computers in ways other than just remedial CAI programs in order to obtain computer literacy and computer science skills.

2. For state policy it is recommended that in an era of limited local resources the implication of have versus have-not schools should instigate state initiative to provide computers for all schools for use by all students. Of particular concern are rural schools and schools with limited resources.

3. For researchers, since the patterns of funding sought and acquired for establishing computer education programs appear to be determining factors in the usage of computers, more creative ways should be investigated to guarantee adequate programs with equitable access to all students.

References

Alvarado, A. L. (1984). Computer education for all students. The Computing teacher, 11, 14-16.

Anderson, R. E., et al. (1982). Assessing computer literacy. (Publication #503), St. Paul, MN; Minnesota Educational Computing Consortium.

Anderson, R. E., et al. (1984). Inequities in opportunities for computer literacy. The Computing Teacher, 11, 10-12.

Anderson, R. E., Welch, W. W., and Harris, L. (1982). Computer inequities and opportunities for computer literacy. Report from Center for Social Research, University of Minnesota, Mineapolis, MN,

Atkinson, R. (1968). Computerized Instruction and the Learning Process, American Psychologist, 23, 226.

Ballas, M. (1984). Electronic evolution: New capabilities enhance ETS services, ETS Developments, Educational Testing Service. Spring, 3.

Bacon, C., et al. (1983). Computer Fear, Education Leadership, 41, 27.

Becker, H. J. (1983-1984). School uses of computers, (Reports from a national survey. Issues No. 1 - No. 6). Baltimore, MD: Johns Hopkins University, Center for Social Organization of schools.

Bell, F. (1978). Can computers really improve school mathematics. Mathematics Teacher, 71, 5, 428-433.

Bock, D. R. and Milevy, R. (1982). The next stage in education assessment. Educational Researcher, 11, 4-11.

Bork, A. Education and computers: The situation today and some possible futures. T.H.E. Technological Horizons In Education Journal, 12, 3, 92-97.

Boyer, E. L. (1984). High School: A report on secondary education in America. The Education Digest, 36-44.

Bracey, G. (1982). Computers in education: What the research shows. Electronic Learning, 2, 3, 51-54.

Cardinale, A. (1982). Education computing, support functions and student objectives. (DS Manual 2350). Washington, D. C. Department of Defense Dependents Schools.

Carver. R. P. et al. (1981). The effect of practice through repeated reading or gain in reading ability using a computer based instructional system. Reading Research Quarterly 16, 3, 374-390.

Charp, S. (1982). Trends-time-sharing, microcomputers networking. T.H.E. Technological Horizons in Education Journal, 10, 82-83.

Christen, K. and Gladstone, P. (1983). El's third annual survey of the states. Electronic Learning, 3, 37-38.

Cowen, R. (1981). New literacy for the computer age. Technology Review May/June, p. 8.

David, A. (1983-1984). Electronic blackboard: Potential for the developing world's education. Journal of Educational Technology Systems, 12, 83-94.

Dede, C. (1981). Educational, social and ethical implications of technological innovation. Programmed Training and Educational Technology, 18, 68.

Del Seni, D. (1984). Local school response to computer equity. The Computing Teacher, 11, 68.

Del Forge, C. and Bloeser, A. (1978) Computer-Assisted-Instruction credited with raising low math scores, (ERIC Document Reproduction Service No. ED 196 686).

D'Ignazio, F. (1983). Beyond computer literacy. Computer

Dence. M. (1980). Toward defining the role of CAI: A review. Educational Technology, 20, 50-54.

Edmonds, R. (1979). Effective schools for the urban poor. Educational Ledership, 13, 15-23.

Edwards, C. (1984). Achieving equity. The Computing Teacher, 11, 62-65.

Euchner, C. (1983). Equal access to computers in education could become major issue, Experts warn. Education Week, 2.

Evans, Christopher. (1982). An invitatiiion to the (near) future. Today's Education, 71, 12-15.

Evans, S. (1974). The redistribution of education as an educational equilizer, Educational Technology, 14, 43-45.

Fagan, E. R. (1984). Selected approaches to computing in reading and language arts. Computers, Reading, and Language Arts (CRLA), 1, 38-40.

Fetler, M. (1984). California Department of Office of Planning, Evaluation and research, an interview. May, 1984.

Fetler, M. (1983). Computer literacy of California sixth and twelfth grade students. A report. Sacramento, CA: Department of Education, Office of Planning Evaluation and Research.

Fortune, R. (1983). The computer - its impact on the classroom. _California School Boards_, _42_.

Fullan, N. and Pomfet, A. (1977). Research curriculum and instructional implementation. _Review of Educational Research_, _47_, 335-397.

Gambrel, J. B. and Sanfield, R. E. (1979). Computers in the school: Too much, too soon? _High School Journal_, _62_, 327-331.

Gebhart, W. (1982). Microcomputers in education. Practical Application of Research, Newsletter of _Phi Delta Kappa_, _4_, 1.

Grayson, L. P. (1984). An Overview of computers in U.S. education. _T.H.E. Technological Horizons in Education Journal_, _12_, _1_.

Hallworth, J. J. and Brebner, A. (1980). _CAI in schools. Achievements, present developments and projections for the future: Executive summary_. (ERIC Document Reproduction Service No. ED 200 187).

Hamblin, J. W. (1978). _Computer literacy and the societal impact of computers: Education and manpower_. (ERIC Document Reproduction Service No. ED 178 049).

Hathaway, W. E., (1983). _Evaluation report on computer use in the Portland public schools_.

Portland, OR: Research and Evaluation Department, Portland Public Schools.

Ingersoll, G. M., Smith, C. B., and Elliot, P. (1983). Microcomputers in American public schools, a national survey. Educational Computer'S, 28-31.

Johnson, D., Anderson, R., Hansen. T. and Klassen, D. (1980). Computer literacy - what is it? Mathematics Teacher, 74, 91-96.

Johnson, J. P. . (1982). Rich school, poor school. Teaching, Learning, Computing, 50-56.

Komoski, K. (1984). Guest editorial. The Computing Teacher, 11, 5-6.

Kurts, B. L. (1980). Investigating the relationship between the development of abstract reasoning and performance in an introductory programming class. Special interest group in Computer Users in Education Bulletin (SIG CUE), 110-117.

Laudon, K. (1977). Communications, technology and democratic participation. New York.

Lipkin, J. P. (1984). Computer equity and computer educators (you). The Computing Teacher, 11, 19-22.

Lipkin, J. P. (1983). Equity in computer education. Educational Leadership, 41, 26-27.

Luehrmann, A. Computer literacy - What it should be. Mathematics Teacher, 74, December.

Praeger F. R. (1984). Equity in computer education. The Computing Teacher, 11, 13-14.

Market data retrieval: Update on the school market for microcomputers. (1982). Market Data Retrieval, 4.

Naisbitt, J. (1982). Megatrends. New York: Warner Books, Inc.

Neter, J. et al. (1985). Applied Linear Statistical Models. (2nd ed.). Homewood, IL: Richard D. Irwin, Inc.

The national commission on excellence in education. (1983). A report to the nation: A nation at risk. The imperative for education reform. American Education, 19, 12.

Papert, S. (1980). Mindstorms. New York: Basic Books, Inc.

Peterson, C. G. and Howe, T. G. (1979). Predicting academic success in introduction to computers. Association for Educational Data Systems Journal. (AEDS), 182-191.

Pogrow, S. (1983). Education in the Compuer Age: Issues of Policy, Practice and Reform. Beverley Hills: Sage Publications.

Ragosta, M. and others. (1982). Computer-Assisted Instruction and Comensatory Education: The ETS/LAUSD Study. (ERIC Document Reproduction Service No. ED 222 169).

Ralston, A. and Meek, C. L. (1976). Encyclopedia of Computer Science. New York: Petrocelli Charter.

Seidel, R. (1982). On the development of an information handling curriculum. In R. Seidel, R. Anderson, and B. Hunter (Eds.), Computer Literacy. (pp 19-20). New York: Academic Press.

Shane, H. (1983). The silicon age II: Living and learning in an information epoch. Phi Delta Kappan, 45, 126-130.

Sheingold, K., et al. (1981). Study of issues related to implementation of computer technology in schools. Final Report. (ERIC Documation Reproduction Service No. ED 210 034).

Smith, H. T., and Green, T. R. G. (1980). Human Interaction With Computers. New York: Academic Press.

Stone, A. (1984). Playing to win in East Harlem. The Computing Teacher. 11, 56-57.

Sturdivant, P. (1984). Access to technology: The equity paradox. The Computing Teacher, 11, 62-65.

Suppes, P., et. al. (1968). Computer-Assisted Instruction: Standford's 1965-66 Arithmetic Program. New York: Academic Press.

Suppes, P. and Morningstar, M. (1972). Computer assisted instruction at Stanford, 1966-68, data models, and evaluation of the arithmetic program. New York: Academic Press, 259.

Taylor, R. (1980). The computer in school: Tutor, tool, tutee. New York: Teachers College Press.

Tobin, C. D. (1983). Developing computer literacy, Arithmetic Teacher, 30, February.

Vinsonhaler, J. and Bass, R. (1972). A summary of ten major studies on CAI drill and practice. Educational Technology. 12.

Walker, D. (1983). Reflections on the educational potential and limitations of microcomputers. Phi Delta Kappan, 65, 103-108.

Walker, R. J. (1980). An update on computers in the classroom. (ERIC Document Reproduction Service No. ED. 204 849).

Watt, D. (1982). Education for citizenship in a computer-based society. In R. Seidel, R. Anderson, and B. Hunter (Eds), Computer Literacy. New York: Academic Press.

Wells, S., et al. (1980). *The impact of varying levels of Computer-Assisted Instruction on the academic performance of disadvantaged students*. (ERIC Document Reproduction Service No. ED 157 899).

Wileman, S., et al. (1981) Factors influencing success in beginning computer science courses. *The Journal of Educational Research*, *74*, 223-226.

Winkle, L. W. and Matthew, W. M. (1982). Computer equity comes of age. *Phi Delta Kappan*, *63*, 14-15.

Wong, R. E., Urmacher, B., and Siegfried, D. (1984). Computers and equity: A pilot program. *The Computing Teacher*. *11*.

APPENDIX A

The term "computer literacy" and "computer science" as used in this report should be understood in light of the described objectives. The number of questions relevant to each objective is written in parentheses after each statement. There were, in all, 430 questions, including 239 for the area of computer literacy and 191 for computer science. The Northwest Regional Educational Laboratory in Portland, Oregon, shared questions that had been written for a DoDDS evaluation and assisted in the question-writing process.

DoDDS Student Objectives

Following are the objectives used as the basis for the curriculum of the Department of Defense Dependents Schools (DoDDS). They are arranged by DoDDS objective category and subcategory numbers. The number after each item is the number of survey items devoted to that objective on the twelfth grade list.

1.0 COMPUTER LITERACY

Demonstrate understanding of the capabilities, applications, and implications of computer technology. (239)

1.1 Interact with a computer and/or other electronic devices. (42)

1.1.1 Demonstrate ability to operate a variety of devices which are based on electronic logic. (8)

1.1.2 Demonstrate ability to use a computer in the interactive mode. (13)

1.1.3 Independently select a program from the computer resource library. (9)

1.1.4 Recognize user errors associated with computer utilization. (12)

1.2 Explain the functions and uses of a computer system. (91)

1.2.1 Use an appropriate vocabulary for communicating about computers. (25)

1.2.2 Distinguish between interactive mode and batch mode computer processing. (9)

1.2.3 Identify a computer system's major components, such as input, memory, processing, and output. (20)

1.2.4 Recognize tasks for which computer utilization is appropriate. (23)

1.2.5 Describe the major historical developments in computing. (23)

1.3 Utilize systematic processes in problem solving. (58)

1.3.1 Choose a logical sequence of steps needed to perform a task. (10)

1.3.2 Diagram the steps in solving a problem. (7)

1.3.3 Select the appropriate tool and procedure to solve a problem. (11)

1.3.4 Develop systematic procedures to perform useful tasks in areas such as social studies, business, science, and mathematics. (12)

1.3.5 Write simple programs to solve problems using a high-level language, such as PILOT, LOGO, or BASIC. (18)

1.4 Appraise the impact of computer technology upon life. (48)

1.4.1 Identify specific uses of computers in fields, such as medicine, law enforcement, industry, business, transportation, government, banking, and space exploration. (12)

1.4.2 Compare computer-related occupations and careers. (13)

1.4.3 Identify social and other nontechnical factors which might restrict computer utilization. (10)

1.4.4 Recognize the consequences of computer utilization. (11)

1.4.5 Differenciate between responsible and irresponsible uses of computer technology. (2)

2.0 COMPUTER SCIENCE

Demonstrate understandings of computer systems including software development, the design and operation of hardware, and the use of computer systems in solving problems. (191)

2.1 Write structured and documented computer software. (95)

2.1.1 Write well-organized BASIC programs which include the use of color, sound, and graphics statements. (41)

2.1.2 Write programs which demonstrate advance programming techniques used to solve problems in business, scientific, or entertainment applications. (19)

2.1.3 Write programs in an additional high-level language such as PASCAL, COBAL, or FORTRAN. (25)

2.1.4 Write programs in a low-level language, such as machine language or assembler. (10)

2.2 Demonstrate knowledge of the design and operation of computer hardware. (57)

2.2.1 Demonstrate unassisted operation of at least two different configurations of computers and their peripherals. (16)

2.2.2 Use a special-purpose computer or computer-interfaced devices to monitor or control events by sensing temperature, light sound, or other physical phenomena. (10)

2.2.3 Describe the computer's digital electronic circuitry in terms of binary arithmetic and logical operators. (19)

2.2.4 Perform vendor-authorized minor maintenance on the computer system. (12)

2.3 Use computer systems in problem solving. (39)

2.3.1 Use data processing utilities, including word processing and data base management, in problem solving. (12)

2.3.2 Translate software from one language to another or to another version of the same language. (11)

2.3.3 Analyze different solutions to the same problem. (16)

APPENDIX B

Appendix B consists of copies of the questionnaires and guides used in this study. They were designed, piloted and used by Sheingold from Bank Street College for a study done for the National Institute of Education (NIE) entitled "A Study of Issues Related to Implementation of Computer Technology in Schools".

GUIDE:

INTERVIEW FOR TEACHERS WHO HAVE CHOSEN NOT TO USE MICROPROCESSORS

Teacher________________________ School__________________________

Class__________________________ Grade/Level______________________

Interviewer_______________________________

1. Can you tell me about how microcomputers are presently being used in this school?

   subject matter areas
   selection of teachers
   applications
   administrative encouragement and support
   students reactions

2. Describe the process by which computers were introduced in this school system and the factors that influenced their diffusion in the schools.

   early beginnings - who? why?
     initial intent
   source of funds
   formal/informal groups for decision-making
   selection of teachers
   role of teachers in implementation process
   administrative support
   allocation of equipment
   community support

3. What are the benefits and drawbacks of the use of microprocessors? (source of information)

   equity
   efficiency
   quality education (define) has there been
     a change in the process or goals of education
   remedial instruction
   individualized instruction
   computer literacy

GUIDE:

INTERVIEW FOR TEACHERS WHO HAVE CHOSEN NOT TO USE MICROPROCESSORS

4. What are your reasons for choosing not to use micros at this time?

   Are there circumstances under which you might want to use them?

5. Given your thoughtful opposition, if you were responsible for developing policy about the instructional use of micros, and had unlimited money and talented people, what would you do?

GUIDE:

INTERVIEW FOR COMMUNITY LEADERS INTERESTED IN MICROCOMPUTER POLICIES

Teacher________________________ Organization________________________

Position________________________ Interviewer________________________

HISTORY

1. What has been your role (or the role of your organization) in influencing the use of microcomputers in the public schools?

    early beginnings - who's involved; goals and reasons?
    diffusion
    motivations for involvement
    role in other innovations
    special expertise?

USE

2. How and where are microcomputers used in the school system?

3. What are the benefits and drawbacks of the use of microcomputers in the schools?

    school system
    teachers
    students

GUIDE:

INTERVIEW FOR COMMUNITY LEADERS INTERESTED IN MICROCOMPUTER POLICIES, cont.

CONTEXT

4. Over the last few years, what factors have been influential in shaping school policy in this community?

    demography - populations served
      population changes - size
      minority groups
      socio-economic status
    local employment opportunities
    goals for public education - diversity
    economy - in general
      specifically - budget/taxes
    general attitude toward innovation

5. Have these factors had any impact on the allocation or use of microcomputers in the schools?

6. In the last five years, what were some of the principal issues between community groups and the schools?

    who was involved:
    issue - economic issues
            curriculum content
            school discipline
            pupil assignment to school
            budgets
            union negotiations

7. Have these issues influenced the use of computers in any way?

    specify active groups or individuals

GUIDE:

INTERVIEW FOR COMMUNITY LEADERS INTERESTED IN MICROCOMPUTER POLICIES, cont.

FUTURE

8. Looking to the future, how do you expect computers will be used in your school system in five years?

    influencing factors
    allocation, diffusion
    changes in educational values
      (e.g., interest in math, science)
    changes in authority relationships

9. If you could plan for the use of microcomputers in a school system with unlimited resources, what plans would you make?

GUIDE:

INTERVIEW FOR MEMBERS OF THE BOARD OF EDUCATION

Name_______________________ Board______________________________

Interviewer______________________

HISTORY

1. How did the instructional use of microcomputers get started in this community?

   early beginnings - individuals involved, motivations, initial intent
   diffusion
   role of state and local educational agencies
   role of public and private institutions
   role of computer hardware and software firms
   involvement of computer-skilled professionals from the community

2. What has been the role of the School Board in developing a computer program in the schools?

   oversight relationship
   budget considerations
   typical of role in innovations?
   attitudes of individual board members

USE

3. How and where are microcomputers used in the school system at the present time?

   allocation
   uses - remedial instruction
   individualized instruction
   computer literacy

GUIDE:

INTERVIEW FOR MEMBERS OF THE BOARD OF EDUCATION, cont.

CONTENT

4. Over the last few years, what major factors have been influential in shaping school policy in this community?

    demography - populations served
        population changes - size
            minority groups
            socio-economic status
    local employment opportunities
    goals for public education - diversity
    economy - in general
        specifically budget/taxes
    general attitude toward educational innovation

5. Have these factors had any impact on the allocation or use of microcomputers in the schools?

6. In the last five years, what were some of the principal issues between community groups and the schools?

    economic issues
    curriculum content
    school discipline
    pupil assignment to schools
    union negotiations
    general relationships between BOE, administration and teachers

7. Have these issues influenced the use of microcomputers in any way?

    specify active groups or individuals

GUIDE:

INTERVIEW FOR MEMBERS OF THE BOARD OF EDUCATION, cont.

8. What have been the benefits and drawbacks of using microcomputers in the schools?

    school system
    teachers
    students

FUTURE

9. Looking to the future, how do you expect microcomputers will be used in your school system in five years?

    allocation; diffusion
    changes in education values
      (e.g., interest in math, science)
    role of state and local agencies
    role of hardware and software firms
    changes in authority relationships
    personnel

    tie-in with answer to #8 if appropriate

10. If you could plan for the use of microcomputers in a school system with unlimited resources, what plans would you make?

GUIDE:

INTERVIEW FOR DISTRICT ADMINISTRATORS

Name______________________ District__________________________

Position__________________ Interviewer_______________________

USE

1. How are microcomputers being used in your school system?

    purpose: remedial instruction
             individualized instruction
             computer literacy
    schools served
    pupils served
    subject areas

HISTORY

2. How did the program come about?

    beginnings - who involved, initial intent
    community support
    groups for decision making - formal/informal
    teacher training
    representation of various schools
    role of teachers in implementation process (software; hardware)
    role of state and local agencies
    role of hardware and software firms
    position of professional associations, unions
    any new personnel

GUIDE:

INTERVIEW FOR DISTRICT ADMINISTRATORS, cont.

3. How is the program financed?

   Initial source of funds - budget
   increase; trade off; extra funds

   ~~Continuing source of funds~~

   Allocation of monies within program
   hardware
   software
   training

   Who are the recipients and how is
   it decided?

4. Describe the factors that influenced which schools and teachers became involved with computers and which did not.

EFFECTS

5. What are the effects of the use of microcomputers on

   a) administration
      functions
      broad educational goals
      budgets

   b) teachers
      working conditions -
      role change
      training

   c) students
      interest in particular
      disciplines
      equity
      parents' attitudes

GUIDE:

INTERVIEW FOR DISTRICT ADMINISTRATORS, cont.

6. How do you feel about the impact of microcomputers in your school system?

   schools
   teachers
   students

7. What are the factors in the relationship between the schools and the community which influenced the use of computers?

   general economy - budget and taxation
     in particular
   changing enrollment - numbers;
     populations served
   employment opportunities
   interest in computers

   existing conflicts -
     curriculum content
     school discipline
     assignment of pupils to schools

FUTURE

8. What do you envision as the future of microcomputers in your school system in the next five years? Describe both positive and negative possibilities and the conditions that will promote positive outcomes.

9. If you could plan for microcomputer implementation in a school system with unlimited resources, what would you do?

GUIDE:

INTERVIEW FOR SCHOOL ADMINISTRATORS

Name ____________________ School ____________________________

Position ________________ Interviewer ________________________

USE

1. How are microcomputers being used in your school?

    purpose: remedial instruction
    individualized instruction
    computer literacy
    pupils served
    subject areas

HISTORY

2. How did the program come about?

    beginnings - who involved, initial intent
    community support
    groups for decision making formal/informal
    teacher training
    role of teachers in implementation process (software; hardware)
    role of state and local agencies
    role of hardware and software firms
    position of professional associations, unions
    any new personnel

GUIDE:

INTERVIEW FOR SCHOOL ADMINISTRATORS, cont.

3. How is the program financed?

   Initial source of funds - budget
   increase; trade off; extra funds

   Continuing source of funds -

   Allocation of monies within program
   hardware
   software
   training

   Who are the recipients and how is
   it decided?

4. Describe the factors that influenced which teachers became involved with computers and which did not.

EFFECTS

5. What are the effects of the use of microcomputers on

   a) administration
      functions
      broad educational goals
      budgets

   b) teachers
      working conditions -
      role change
      training

   c) students
      interest in particular
      disciplines
      equity
      parents' attitudes

GUIDE:

INTERVIEW FOR SCHOOL ADMINISTRATORS, cont.

6. How do you feel about the impact of microcomputers in your school?

    school
    teachers
    students

7. What are the factors in the relationship between the school and the community which influence the use of computers?

    general economy - budget and
      taxation in particular
    changing enrollment - numbers;
      populations served
      employment opportunities
      interest in computers?

    existing conflicts -
      curriculum content
      school discipline
      assignment of pupils to schools

FUTURE

8. What do you envision as the future of microcomputers in your school in the next five years? Describe both positive and negative possibilities and the conditions that will promote positive outcomes.

9. If you could plan for microcomputer implemenation in a school with unlimited resources, what would you do?

GUIDE:

INTERVIEW FOR STUDENTS

Student____________________ School____________________________

Class______________________ Grade/Level________________________

Interviewer__________________________

USE

1. In what ways is the microcomputer used in your class?

    activities
    fit in with the rest of the class
    monitoring of work
    is what was observed typical of its use?

2. Who uses the computer?

    number of students
    time
    equity
      boys/girls
      high-achievers/low-achievers
    do students have choices about
      when and how it's used?
    computer sub-culture - uses on
      weekends and after school

3. Do you use microcomputers in other classes or as part of your extra-curricular activities? If so, what kinds of things do you do with the computer?

    activities
    amount of time
    required/not required

GUIDE:

INTERVIEW FOR STUDENTS, cont.

EFFECTS

4. How do you feel about working with the computer?

   motivation; persistance
   attitudes toward subject matter
   durability of hardware
   do some students dislike it? Why?

5. How is the teaching in classes with microcomputers different from the teaching in classes where computers aren't used?

   instructional goals
   (problem-solving; drill)
   student-student interaction
   (collaboration; competition)
   teacher-student relationships - authority

   do students develop software or teach others to use the equipment?

6. What have you learned through working with a microcomputer?

   academic achievement
   cognitive development problem solving; analysis
   social/emotional development

   Are there things that you think you could learn better from a computer than from a teacher?

   Are there things that you think you could learn better from a teacher than from a computer?

   Have you learned any skills through using the computer that you use in other courses?

7. What are the advantages and disadvantages in using computers as one way of helping students learn?

APPENDIX C

Appendix C contains the California State Department of Education Consolidated Programs Description Database (SDE/CPDD-3, 11/84). These are curriculum profiles of the four schools researched in this tudy. The profiles are data obtained by the State Department of Educatiion about individual schools in the State of California. The source of the information are varied (CAP tests, CBEDS, Language Census Data) and are apt to be collected and compiled over a period of two or three years.

HIGH SCHOOL CURRICULUM PROFILE

CDS code: 07-61721-0733980

County: CONTRA COSTA

District: LIBERTY UNION HIGH

School: LIBERTY HIGH

Grade levels: 9-12

Enrollment (1982-83): 1,257

Enrollment (1983-84): 1,349

High school graduates (1982-83): 237

Percent AFDC (1983-84): 8.11

No. of certificated staff (1983-84 FTE): 64.66

No. of teachers (1983-84 FTE): 54.46

Avg. cert. salary (1983-84): $ 25,851

Avg. teacher salary (1983-84): $ 24,840

CBEDS COURSE ENROLLMENT DATA

*Percent of student body enrolled in:	1982-83	1983-84
ANY ENGLISH CLASS	107	105
Reading Develop./Improve. . .	15	14
Literature.		
English as a Second Lang. . .	5	4
Writing		
Oral Language		
ANY MATH CLASS.	72	68
General Math.	35	26
Algebra/Geometry.	26	34
Advanced Math	10	6
ANY SCIENCE CLASS	31	30
Life Science.	24	21
Physical/Earth Science. . . .	7	9
ANY SOCIAL STUDIES CLASS. . . .	63	70
U.S. Government	12	13
U.S. History.	25	25
World History	15	24
ANY FOREIGN LANGUAGE CLASS. . .	25	24
ANY COMPUTER EDUCATION CLASS. .		4
ANY FINE ARTS CLASS	48	47
SELF-CONTAINED CLASSROOMS . . .		

*Percent may be over 100 if students take more than one class in a subject area

CALIFORNIA ASSESSMENT PROGRAM DATA

Course completion (1983-84)

Percent of 12th graders tested who completed at least:

4 years of English	57%
3 years of Math	54%
3 years of Science	26%
4 years of Soc. Stud.	9%
3 years of For. Lang.	11%
1 year of Fine Arts	67%

LANGUAGE CENSUS DATA

	1982-83	83-84
LEP students	107	49
Primary language:		
Spanish:	104	47
Vietnamese:		
Cantonese:		
Other:	3	2

12th grade results

1983-84 School Comparison Group = B

		1981-82	1982-83	1983-84
Math	%ile rank	27	24	17
	score band	W	B	B
Read	%ile rank	20	27	34
	score band	B	W	W
Lang	%ile rank	28	34	18
	score band	W	W	B
PEI %ile rank		19	32	31
Number tested			252	240
Percent tested				78

School Comparison Group = The group to which this school belongs on the School Performance Report

%ile rank = The statewide percentile rank for a school CAP test score

A = Above comparison score band
B = Below comparison score band
W = Within comparison score band

PEI = parent education index

CDS code: 01-61192-0133629

County: ALAMEDA

District: HAYWARD UNIFIED

School: HAYWARD HIGH

Grade levels: 8,9,10,11,12

Enrollment (1982-83): 1,237

Enrollment (1983-84): 1,553

High school graduates (1982-83): 247

Percent AFDC (1983-84): 6.47

No. of certificated staff (1983-84 FTE): 73.12

No. of teachers (1983-84 FTE): 62.62

Avg. cert. salary (1983-84): $ 28,724

Avg. teacher salary (1983-84): $ 28,150

CBEDS COURSE ENROLLMENT DATA

*Percent of student body enrolled in:	1982-83	1983-84
ANY ENGLISH CLASS	95	92
Reading Develop./Improve. . .	2	14
Literature.	7	15
English as a Second Lang. . .		
Writing	14	3
Oral Language	1	
ANY MATH CLASS.	67	81
General Math.	20	24
Algebra/Geometry.	27	32
Advanced Math	8	7
ANY SCIENCE CLASS	49	38
Life Science.	9	17
Physical/Earth Science. . . .	18	14
ANY SOCIAL STUDIES CLASS. . . .	166	88
U.S. Government	20	17
U.S. History.	24	32
World History	1	
ANY FOREIGN LANGUAGE CLASS. . .	33	29
ANY COMPUTER EDUCATION CLASS. .	6	6
ANY FINE ARTS CLASS	65	60
SELF-CONTAINED CLASSROOMS . . .		

*Percent may be over 100 if students take more than one class in a subject area

CALIFORNIA ASSESSMENT PROGRAM DATA

Course completion (1983-84)

Percent of 12th graders tested who completed at least:

4 years of English	71%
3 years of Math	61%
3 years of Science	30%
4 years of Soc. Stud.	38%
3 years of For. Lang.	24%
1 year of Fine Arts	94%

LANGUAGE CENSUS DATA

	1982-83	83-84
LEP students	60	68
Primary language:		
Spanish:	17	26
Vietnamese:		3
Cantonese:		4
Other:	43	35

12th grade results

1983-84 School Comparison Group = C

		1981-82	1982-83	1983-84
Math	%ile rank	53	45	58
	score band	W	B	W
Read	%ile rank	37	54	68
	score band	B	W	A
Lang	%ile rank	33	37	54
	score band	B	B	W
PEI %ile rank		68	65	58
Number tested			248	259
Percent tested				94

School Comparison Group = The group to which this school belongs on the School Performance Report

%ile rank = The statewide percentile rank for a school CAP test score

A = Above comparison score band
B = Below comparison score band
W = Within comparison score band

PEI = parent education index

CDS code: 41-68924-4133393	Grade levels: 9-12	No. of certificated staff (1983-84 FTE): 73.44
County: SAN MATEO	Enrollment (1982-83): 1,351 / Enrollment (1983-84): 1,344	No. of teachers (1983-84 FTE): 62.73
District: JEFFERSON UNION HIGH	High school graduates (1982-83): 251	Avg. cert. salary (1983-84): $ 27,817
School: JEFFERSON HIGH	Percent AFDC (1983-84): 8.29	Avg. teacher salary (1983-84): $ 27,146

CBEDS COURSE ENROLLMENT DATA

*Percent of student body enrolled in:	1982-83	1983-84
ANY ENGLISH CLASS	118	105
Reading Develop./Improve. . .	11	15
Literature.		
English as a Second Lang. . .	12	11
Writing		
Oral Language		
ANY MATH CLASS.	94	85
General Math.	54	43
Algebra/Geometry.	18	30
Advanced Math	14	7
ANY SCIENCE CLASS	34	39
Life Science.	8	9
Physical/Earth Science. . . .	14	9
ANY SOCIAL STUDIES CLASS. . . .	106	98
U.S. Government	19	14
U.S. History.	24	22
World History	9	10
ANY FOREIGN LANGUAGE CLASS. . .	63	25
ANY COMPUTER EDUCATION CLASS. .		
ANY FINE ARTS CLASS	32	17
SELF-CONTAINED CLASSROOMS . . .		

*Percent may be over 100 if students take more than one class in a subject area

CALIFORNIA ASSESSMENT PROGRAM DATA

Course completion (1983-84)

Percent of 12th graders tested who completed at least:

4 years of English	83%
3 years of Math	85%
3 years of Science	40%
4 years of Soc. Stud.	62%
3 years of For. Lang.	17%
1 year of Fine Arts	55%

LANGUAGE CENSUS DATA

	1982-83	83-84
LEP students	440	461
Primary language:		
Spanish:	268	279
Vietnamese:	2	2
Cantonese:	14	10
Other:	156	170

12th grade results

1983-84 School Comparison Group = B

		1981-82	1982-83	1983-84
Math	%ile rank	9	10	9
	score band	B	B	B
Read	%ile rank	8	8	10
	score band	B	B	B
Lang	%ile rank	8	9	7
	score band	B	B	B
PEI %ile rank		26	31	32
Number tested			259	260
Percent tested				86

School Comparison Group = The group to which this school belongs on the School Performance Report

%ile rank = The statewide percentile rank for a school CAP test score

A = Above comparison score band
B = Below comparison score band
W = Within comparison score band

PEI = parent education index

HIGH SCHOOL CURRICULUM PROFILE

CDS code: 43-69401-4338505	Grade levels: 9-12	No. of certificated staff (1983-84 FTE): 64.06
County: SANTA CLARA	Enrollment (1982-83): 1,449 / Enrollment (1983-84): 1,359	No. of teachers (1983-84 FTE): 55.06
District: CAMPBELL UNION HIGH	High school graduates (1982-83): 361	Avg. cert. salary (1983-84): $ 32,987
School: WESTMONT HIGH	Percent AFDC (1983-84): 2.63	Avg. teacher salary (1983-84): $ 31,718

CBEDS COURSE ENROLLMENT DATA

*Percent of student body enrolled in:	1982-83	1983-84
ANY ENGLISH CLASS	94	86
Reading Develop./Improve. . .		
Literature.	12	19
English as a Second Lang. . .	2	
Writing		
Oral Language	2	2
ANY MATH CLASS.	84	65
General Math.	6	6
Algebra/Geometry.	22	21
Advanced Math	35	24
ANY SCIENCE CLASS	38	30
Life Science.	7	11
Physical/Earth Science. . . .	16	15
ANY SOCIAL STUDIES CLASS. . . .	76	70
U.S. Government	12	11
U.S. History.	12	14
World History		
ANY FOREIGN LANGUAGE CLASS. . .	39	40
ANY COMPUTER EDUCATION CLASS. .	4	8
ANY FINE ARTS CLASS	23	18
SELF-CONTAINED CLASSROOMS . . .	2	1

*Percent may be over 100 if students take more than one class in a subject area

CALIFORNIA ASSESSMENT PROGRAM DATA

Course completion (1983-84)

Percent of 12th graders tested who completed at least:

4 years of English	94%
3 years of Math	64%
3 years of Science	28%
4 years of Soc. Stud.	23%
3 years of For. Lang.	35%
1 year of Fine Arts	54%

LANGUAGE CENSUS DATA

	1982-83	83-84
LEP students	24	17
Primary language:		
Spanish:	3	2
Vietnamese:	13	12
Cantonese:	4	
Other:	4	3

12th grade results

1983-84 School Comparison Group = E

		1981-82	1982-83	1983-84
Math	%ile rank	90	82	83
	score band	A	W	W
Read	%ile rank	88	80	78
	score band	W	W	W
Lang	%ile rank	88	85	77
	score band	W	W	W
PEI %ile rank		83	80	82
Number tested			325	286
Percent tested				85

School Comparison Group = The group to which this school belongs on the School Performance Report

%ile rank = The statewide percentile rank for a school CAP test score

A = Above comparison score band
B = Below comparison score band
W = Within comparison score band

PEI = parent education index