California State University, San Bernardino
CSUSB ScholarWorks

Theses Digitization Project | John M. Pfau Library

1995

A study to define secondary computer literacy programs: Implications for restructuring vocational education policy directions

Tracy Schneider Borchers

Follow this and additional works at: https://scholarworks.lib.csusb.edu/etd-project

Part of the Vocational Education Commons

Recommended Citation

Borchers, Tracy Schneider, "A study to define secondary computer literacy programs: Implications for restructuring vocational education policy directions" (1995). *Theses Digitization Project*. 1059.
https://scholarworks.lib.csusb.edu/etd-project/1059

This Thesis is brought to you for free and open access by the John M. Pfau Library at CSUSB ScholarWorks. It has been accepted for inclusion in Theses Digitization Project by an authorized administrator of CSUSB ScholarWorks. For more information, please contact scholarworks@csusb.edu.

A STUDY TO DEFINE SECONDARY COMPUTER LITERACY PROGRAMS: IMPLICATIONS FOR RESTRUCTURING VOCATIONAL EDUCATION POLICY DIRECTIONS

A Thesis

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education: Vocational Education

---

by

Tracy Schneider Borchers

June 1995

A STUDY TO DEFINE SECONDARY COMPUTER LITERACY PROGRAMS: IMPLICATIONS FOR RESTRUCTURING VOCATIONAL EDUCATION POLICY DIRECTIONS

A Thesis Presented to

The Faculty of

California State University,

San Bernardino

---

by

Tracy Schneider Borchers

June, 1995

Approved by:

[redacted] 4/17/95

Dr. Theodore H. Zimmerman Date

[redacted]

Dr. Ronald K. Pendleton

A STUDY TO DEFINE SECONDARY COMPUTER LITERACY PROGRAMS: IMPLICATIONS FOR RESTRUCTURING VOCATIONAL EDUCATION POLICY DIRECTIONS

A Thesis Presented to

The Faculty of

California State University,

San Bernardino

---

by

Tracy Schneider Borchers

June, 1995

Approved by:

Joseph English — April 22, '95

Dr. Joseph English — Date

Abstract

The study examined the degree to which student computer literacy programs have existed in selected districts and high schools in the Los Angeles and San Bernardino counties of Southern California. Principals from regular day high schools were surveyed to determine the competencies, performance objectives, criteria, sources of input and outcome objectives identified and included in the district and schools plans for student computer literacy in terms of workplace preparation. Data were analyzed and frequencies and percentages were calculated. An examination of the data indicated that schools have given little consideration to the needs of employers or students in terms of workplace computer literacy skills. Findings suggested the programs that have existed are lacking in structure and effectiveness. Further investigation of the findings concluded that schools and districts have not made the connection between school learning and the real-life context of work. It was recommended that the California State Department of Education create a "blue ribbon" committee consisting of industry and educational representatives to establish state guidelines for effective computer literacy programs. It was also recommended that federal legislation address the need for industry standards to be considered in the design of student computer literacy programs. A definition of computer literacy was recommended, identifying the competencies and performance objectives necessary to prepare students for workplace computer literacy. Lastly, a recommendation was made to research and develop a program to prepare and certificate instructors for teaching computer literacy skills.

Acknowledgments

My sincerest thanks to my husband Anthony, for his emotional support and loving understanding through the trying times of my graduate studies.

I wish to express my heartfelt thanks to my parents for their continued support throughout my academic and professional endeavors. Their own educational accomplishments have provided me with the inspiration to pursue my goals.

I would like to thank my faculty advisor, Dr. Theodore Zimmerman for his comments, corrections, and suggestions throughout the process. His guidance provided the direction needed to work through this process.

I would like to express my appreciation to my colleagues at Tech Ed Services, who provided me with much needed support and understanding throughout my masters work.

I am deeply grateful to my former advisor and current mentor, Dr. Joseph English for his keen guidance and insightful comments. This manuscript was significantly strengthened by the detailed feedback and ideas he provided. Had it not been for his encouragement, this manuscript would probably still be incomplete.

A special thanks goes to my close friends and fellow students, Victor Corey Davis and Sandra Studenny Marquez, for their support, and encouragement. Their reviews of this manuscript at various points in it preparation provided me with thoughtful and insightful comments that were helpful in its development.

Table of Contents

Abstract.....iii

Acknowledgments..... iv

List of Tables..... viii

List of Figures..... ix

Chapter One---Introduction..... 1

Background of the Study..... 1

Nature of the Problem..... 1

Significance of the Problem..... 2

Statement of the Problem..... 3

Questions Guiding the Study..... 3

Purpose of the Study..... 4

Limitations of the Study..... 4

Assumptions..... 5

Definitions..... 6

Chapter Two---Review of Literature..... 8

Introduction..... 8

Early Development..... 8

Computer Literacy Defined..... 9

Recent Federal Legislation..... 11

Implications for Workplace Education..... 16

Contextual Learning..... 17

Summary of the Literature Review 22

Chapter Three---Research Design and Procedures 24

Theoretical Base of the Study 24

Research Questions 25

Questionnaire 25

Population Sample and Description 26

Procedures 26

Methods of Treatment of Data 27

Validity 28

Chapter Four---Findings and Discussion 29

Introduction 29

Demographic Findings 29

District Findings 33

School Findings 37

Other Findings 42

Discussion of the Findings 47

Population demographics 47

Research question 1 48

Research question 2 50

Research question 3 50

Research question 4 51

Research question 5 55

Summary of Findings and Discussion 56

Chapter Five---Conclusions and Recommendations 58

Conclusions 58

Recommendations 61

Blue ribbon committee 61

Federal legislation 62

Computer literacy identified 64

Instructor certification requirements 65

Summary 66

APPENDIX A: 67

Telephone Introduction 68

APPENDIX B: 69

Survey Questionnaire 70

References 75

List of Tables

Table 1. Competencies Included in District Plan 34

Table 2. District Student Performance Objectives 35

Table 3. District Selection Criteria 36

Table 4. District Sources of Input 36

Table 5. Competencies Included in School Plan 38

Table 6. School Student Performance Objectives 39

Table 7. School Measurements for Outcome Objectives 40

Table 8. School Selection Criteria 41

Table 9. School Sources of Input 41

Table 10. New Equipment Selection Criteria 43

Table 11. School Sources of Input 44

List of Figures

Figure 1. SCANS - Five Competencies 14

Figure 2. SCANS - A Three-Part Foundation 15

Figure 3. Characteristics of ideal learning 19

Figure 4. Years as Principal 30

Figure 5. Years Teaching 30

Figure 6. Office computer use hours per week 31

Figure 7. Home computer use hours per week 32

Figure 8. Principals by Age 33

Figure 9. New purchases 42

Figure 10. Computer Platform of Area Corporations 45

Figure 11. Computer Platform Most Represented at School 46

Figure 12. Principal's Proficiency Ratings 48

Figure 13. Workplace Know-How 63

Chapter One

Introduction

Background of the Study

The rapid evolution of technology and the shift from an international market to a global economy has brought about a need for a technologically skilled workforce. Nearly twelve years ago, in its report *A Nation At Risk*, the U.S. Department of Education declared computer competence was becoming a fourth basic skill, as necessary for an educated person as reading, writing, and arithmetic (Kondracke, 1992). Yet, as recent as 1991, the Secretary's Commission on Achieving Necessary Skills (SCANS) reported that more than half of all young people leave school without the knowledge or foundation required to find and hold a good job (SCANS Report, 1991). The study was designed to investigate and determine the factors affecting the implementation of computer literacy offered in the curriculum of selected regular day high schools in the San Bernardino and Los Angeles counties of Southern California.

Nature of the Problem

The apparent shift from an industrial society to an information society continues to change the structure of the workplace. Workers in the information age need a solid understanding of technology in order to advance with it. Computers are impacting all aspects of society from our personal lives to the very nature of our jobs. Innovations in microchip technology has brought computerization to the general public. We now live in

a world of cellular phones, satellite communications, global pagers, and computer super highway networks. If schools are to prepare youth to be competitive in a global technological economy, they will need to first identify the components that constitute computer literacy.

Significance of the Problem

A recent report by the U.S. Department of Labor, U.S. Department of Education and the U.S. Department of Commerce concluded that the gap between what employers need and the qualifications of entry-level workers in technologically oriented workplaces is widening (Wiggs, 1992). Furthermore, technology's impact is evident in the changing job market. Workers in the 1990s and beyond are expected to be competent to use technology effectively, and employers hire employees who demonstrate the skills and ability to use technology (Policy Statements, 1993). In recent years society in general, has become increasingly computer familiar; learning about computers through mass media, friends and family, home computers and general exposure. However, students are still leaving school without the basic computer literacy skills needed to compete and actively participate in today's technological society. Raizen (1989) stated:

> There are...several factors affecting vocational education today that...are qualitatively different from earlier social and economic changes:
> The U.S. economy's need for a technologically highly sophisticated workforce because of the development of a global economy and the advance of communication technologies;
> The changing composition of the labor force, which will be made up of increasing numbers of individuals for whom the current programs have not been successful;

> The current wave of educational reform and its effects on enrollments in vocational education programs; and
> New research findings from cognitive science on how people learn in and out of school. (p. 4)

Statement of the Problem

According to the experts, schools are not preparing students with the necessary skills to compete in a global technologically driven economy. In fact, policymakers and analysts have become increasingly concerned that the education and training system in the U.S. is not adequate to play its expected role in preparing people for the workplace. They point out that changes in technology and work have implications for the relative roles of vocational training and education in schools and in the workplace in preparing the nation's workforce. Consequently, workers who are technologically skilled are more employable than those who are unskilled (Bailey, 1990). Therefore, the problem shall be to define the nature of what constitutes computer literacy skills, as offered in regular day high schools.

Questions Guiding the Study

The study was designed to investigate and determine the degree to which written plans for student computer literacy existed in the curriculum of selected regular day high schools in the San Bernardino and Los Angeles counties of Southern California. Therefore, the study addressed questions surrounding the definition of computer literacy; the degree to which written plans for student computer literacy existed; the extent to

which schools and districts have identified the components necessary to prepare students to become computer literate; and how schools are measuring the outcome objectives that were identified.

Purpose of the Study

The challenge is to prepare students with computer literacy skills that will enable them to have the ability and flexibility to keep pace with technology as it evolves in the workplace. It will be necessary for students to have the skills and capabilities to meet the needs of business and industry in the upcoming years and become an employable, productive participant in society. Therefore, the purpose of the study was to generate data necessary to define the nature of computer literacy in selected Los Angeles and San Bernardino county high schools.

Limitations of the Study

The framework for this project drew information from various studies, papers, and professionals representing a comprehensive range of disciplines and regions. The literature review identified recent Federal legislation and current research in learning theories. The focus of legislation was limited to the *School-To-Work Opportunities Act*, the *SCANS* report and *Goals 2000: Educate America*, whose intent was the identification of basic competencies necessary for students to compete in the workforce of the twenty-

first century. The review of selected literature explored what roles these played in regards to computer literacy skills.

The sample population was a random selection of regular day high schools from the Los Angeles and San Bernardino counties of Southern California. Applicability of the study to all high school student computer literacy programs may be limited due to inconsistencies between schools and school districts in regards to planning procedures and policies.

The study was prompted by personal observations to a number of regular day high schools. These may be isolated cases and not representative of the norm for regular day high school computer literacy programs. The study was an attempt to expand on the observations and determine the validity.

Assumptions

The following assumptions were made regarding this study: (a) the principals surveyed were qualified to answer questions regarding the districts' and schools' computer literacy program. Of the regular day high schools who indicated the district and/or the school had a written plan for student computer literacy, (b) the principals were knowledgeable about and familiar with the district's written plan for student computer literacy; and (c) the principals were knowledgeable about and familiar with the school's written plan for student computer literacy. Changes in behavior of the

participants (Hawthorne effect) many have occurred causing respondents to indicate responses to questions that they may not have indicated under other circumstances.

Definitions

The following definitions are intended to help the reader understand the terms used in the study.

Cognitive theory - The theory that learning is a process of knowledge rather than knowledge absorption and storage; that learning is closely related to the context is which it takes place.

Contextual learning - A learning process which ties the concepts being taught to the specific context in which it will be used or applied.

Computer literacy - The knowledge and skills necessary for a person to be proficient to interact with computer technologies and to access computerized information.

Computer platform - The type of operating system that differentiates the corresponding hardware and software. For the purpose of this study, there are three platforms identified, they are: IBM/Clone, Macintosh, and Apple II.

Hawthorne effect - Refers to the tendency of people to act differently because they realize they are subjects in a study.

Principals - Full time administrative supervisor assigned to the high school.

Regular day high schools - These are four-year high schools with grades 9 through 12 and daytime instruction.

Systemic reform - The process aimed at improving the educational system as a whole, by determining how the various levels of state and local governments can work together.

Transfer of knowledge - The learning of new ideas and the application of the ideas to specific situations.

Vocational Education - A generic term for reflecting formalized experiences associated with exploring and preparing for the world of work. Terms that are closely associated with it are occupational education, technical education, employment training, and career preparation.

Chapter Two

Review of Literature

Introduction

As society approaches the twenty-first century, and moves into the information age, more students than ever before need to become computer literate to be able to compete successfully in the increasingly technological job market. Moreover, schools must prepare students with broad technical skills that will enable them to continue to learn and adapt new skills with the evolving technology of the emerging global economy.

Early Development

The need for computer literacy skills was heavily debated in the early 1970's when Andrew Molnar of the National Science Foundation wrote a paper entitled *The Next Great Crisis in American Education: Computer Literacy*. The debate over computer literacy differed significantly from prior debates in computer education because of the premise that everyone should be literate (Dutton & Anderson, 1989). The debate stagnated when no consensus could be reached regarding the definition of computer literacy and interest waned. However, the topic picked up momentum again in the early 1980's when Apple Computer and International Business Machines Corporation (IBM) introduced the first personal computers to the consumer marketplace and schools. Designed for home users and small businesses, the computers offered limited

applications in word processing, personal finance, programming and games. Although slow and difficult to work with, the small, reasonably priced systems brought with them a new era of technological advancement and the heightened need for broad computer literacy skills.

Computer Literacy Defined

Since personal computers first became available for general use in the late 70's and early 80's, there have been countless debates over what constitutes computer literacy. Some educators equated computer literacy with keyboarding skills, others with programming. Many argued that it should encompass all of these skills, as well as sensitivity to the social issues of technology (Dutton et al.). Garret & Lundgren, in their 1992 report, concluded that contemporary computer literacy requires an understanding of the role of the computer as a part of an overall information system. This broad-based knowledge should extend to the hardware, the applications software, and the connected operations that are involved in putting these elements together to accomplish a task. As stated by Garret et al., all of these elements together are "...the essence of a computer information system" (p. 11).

As computers become ubiquitous to society, it has been recognized that fundamental computer literacy is more than just operational proficiency in the use of microcomputers, associated peripheral equipment and basic software packages, but includes an understanding of technological communications uses and wider social

implications as well. Biermann (1994) pointed out that many traditional computer literacy courses emphasize learning the vocabulary of computing; gaining some experience with limited software packages such as word processing, spreadsheets, and database systems; and studying the history and social impact of computing, but come up short in providing students with an understanding of the structure and ideas necessary to engage the learner.

Rosenberg, (1991) a critic of computer literacy concurred with Biermann that curriculum course goals that sound good on paper often translate in the classroom into mechanical skills. Knowing how to use a computer, he indicated, means handling floppy disks, and, knowledge of computer technology means pointing out the keyboard in a drawing. Many times, understanding what a computer can do means brief exposure to word-processing and spreadsheet programs. Students who are exposed to word processing, he argues, may be able to format text and send it to print - a convenient and practical skill - but they learn nothing to help them understand and/or intelligently assess computer uses.

Many education and business leaders argue that the current computer literacy courses are too superficial, stating that the experience that students often get in computer literacy courses provides only "watered down" skills. Students rarely have the opportunity to work with the type of software that is routinely used in actual workplaces; usually they work with only limited software packages (Hannum, 1991). Often, literacy courses are narrow in context, addressing the syntax and form of the field. They enable

students to use machines, but they do not engage their intellects in the real excitement of computing (Biermann).

Although numerous courses exist under the heading of computer literacy, there is no widely accepted standard definition. In fact, the California Department of Education stated "We have no working definition of computer literacy." Many employers and professional institutions only offer a fairly broad definition, namely that "being computer literate meant having an awareness of the functions which can be performed by computers and associated hardware and software" (Osborne, 1993, p. 343).

There is an apparent difficulty on the part of experts to define computer literacy stemming from the fact that, although there may be broad agreement on certain key ingredients, there is also scope for a range of interpretations reflecting the particular viewpoint of the interpreter.

Recent Federal Legislation

In 1994, the federal government passed both the School-To-Work Opportunities Act (STWOA) and the Goals 2000: Educate America Act. The STWOA was intended to address issues on how to prepare young people to meet the challenges of, and to succeed in, the highly skilled, highly competitive workplaces of the 21st century. The Goals 2000 Act, Title III was intended to provide funding to states to engage in comprehensive standards-based school improvement. Both federal legislative efforts were intended to provide *systemic reform.*

From the guidelines in the federal plans, each state will develop its own plan for each of the new Acts. The state of California named its version of the STWOA plan the School-To-Career Plan. The federal Acts are designed to help the majority of American youth make a smooth transition from high school to productive and rewarding employment and further learning by integrating academic and vocational learning curriculum and instruction. One of the many purposes of the STWOA is to utilize workplaces as active learning environments in the educational process by making employers joint partners with educators in providing opportunities for all students to participate in high-quality work-based learning experiences. The Goals 2000 legislation supports coordination with vocational education efforts and programs and processes to reach students with special needs. This is a five year plan designed to address all four of the interrelated dimensions of Goals 2000. These dimensions are:

1. standards, assessment, curriculum, and instruction;
2. opportunities for all students to learn;
3. management, governance, and accountability; and
4. partnerships with parents, communities, and other agencies serving children and families.

Two of the goals of the legislation are to develop strategies to integrate technology into school improvement efforts; and to coordinate reform efforts with school-to-work and vocational education programs.

Many of the same elements identified in the STWOA were identified in the earlier SCANS report *What Work Requires of Schools* published in 1991. This report identified five competencies, which, in conjunction with a three-part foundation of skills

and personal qualities, are key to job performance today. These eight ideas, and notably for the purpose of this study, the competencies listed under "Technology," represent essential preparation for all students, both those going directly to work and those planning further education. (see Figures 1 and 2).

Figure 1. SCANS - Five Competencies

Resources:	**Identifies, Organizes, plans, and allocates resources**
A.	*Time* - Selects goal-relevant activities, ranks them, allocates time, and prepares and follows schedules.
B.	*Money* - Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives.
C.	*Material and Facilities* - Acquires, stores, allocates, and sues materials or space efficiently.
D.	*Human Resources* - Assesses skills and distributes work accordingly, evaluates performance and provides feedback.
Interpersonal	**Works with others**
A.	*Participates as Member of a Team* - contributes to group effort.
B.	*Teaches Others New Skills.*
C.	*Serves Clients/Customers* - works to satisfy customers' expectations.
D.	*Exercises Leadership* - communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies.
E.	*Negotiates* - works toward agreements involving exchange of resources, resolves divergent interests.
F.	*Works with Diversity* - works well with men and women from diverse backgrounds.
Information:	**Acquires and uses information**
A.	*Acquires and Evaluates Information.*
B.	*Organizes and Maintains Information.*
C.	*Interprets a and Communicates Information.*
D.	*Uses Computers to Process Information.*
Systems:	**Understands complex inter-relationships**
A.	*Understands Systems* - knows how social, organizational, and technological systems work and operates effectively with them.
B.	*Monitors and Corrects Performance* - distinguishes trends, predicts impacts on system operations, diagnoses deviations in systems' performance and corrects malfunctions.
C.	*Improves or Designs Systems* - suggests modifications to existing systems and develops new or alternative systems to improve performance.
Technology:	**Works with a variety of technologies**
A.	*Selects Technology*- chooses procedures, tools or equipment including computers and related technologies.
B.	*Applies Technology to Task* - Understands overall intent and proper procedures for setup and operation of equipment.
C.	*Maintains and Troubleshoots Equipment* - Prevents, identifies, or solves problems with equipment, including computers and other technologies.

Figure 2. SCANS - A Three-Part Foundation

Basic Skills:	**Reads, writes, performs arithmetic and mathematical operations, listens and speaks.**
A.	*Reading* - locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules.
B.	*Writing* - communicates thoughts, ideas, information, and messages in writing; and creates documents such as letters, directions, manuals, reports, graphs, and flow charts.
C.	*Arithmetic/Mathematics* - performs basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques.
D.	*Listening* - receives, attends to, interprets, and responds to verbal messages and other cues.
E.	*Speaking* - organizes ideas and communicates orally.
Thinking Skills:	**Thinks creatively, makes decisions, solves problems, visualizes, knows how to learn, and reasons.**
A.	*Creative Thinking* - generates new ideas.
B.	*Decision Making* - specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternatives.
C.	*Problem Solving* - recognizes problems and devises and implements plan of action.
D.	*Seeing Things in the Mind's Eye* - organizes, and processes symbols, pictures, graphs, objects, and other information.
E.	*Knowing How to Learn* - uses efficient learning techniques to acquire and apply new knowledge and skills.
F.	*Reasoning* - discovers a rule or principle underlying the relationship between two or more objects and applies it when solving a problem.
Personal Qualities:	**Displays responsibility, self-esteem and perseveres towards goal attainment.**
A.	*Responsibility* - exerts a high level of effort and perseveres towards goal attainment.
B.	*Self-Esteem* - believes in own self-worth and maintains a positive view of self.
C.	*Sociability* - demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings.
D.	*Self-Management* - assesses self accurately, sets personal goals, monitors progress, and exhibits self-control.
E.	*Integrity/Honesty* - chooses ethical courses of action.

According to SCANS, all eight must be an integral part of every young person's school life.

Implications for Workplace Education

The nature of the workplace is changing, demanding workers with certain kinds of aptitudes and abilities which our present educational system is failing to produce, explains Stasz, McArthur, Lewis, & Ramsey (1990). They indicate that major changes in the economy and growing dissatisfaction with the performance of our [high] schools have led to calls for instructional reform from educators, policymakers, researchers, employers, and social critics. They advise the teaching of generic skills as one way to address an increasing labor market problem of demand and supply. Generic skills will enable people to:

1. Cooperate and communicate for group/social problem solving.
2. Identify and define (or structure) problems in complex environments.
3. Seek, acquire, and synthesize new information.
4. Adapt to changes and gaps of information in the problem-solving environment. (p. 1)

According to Stasz, et al., a new emphasis on generic skills assumes that the people who have them can adapt to the changing forms of American industry and the occupational structures supporting it.

Cited from an earlier study by Resnick, Stasz et al., noted that there are fundamental contrasts between in-school and out-of-school mental activity that raise profound questions about the utility and effectiveness of schooling for all non-school activity, including work.

> First , while the dominant form of school learning and performance is individual, much activity outside school is socially shared.

> Second, schools place a premium on "pure thought" activities without the benefit of tools (for example, calculators and books during test taking), whereas most mental activities outside school are shaped by and dependent upon use of available tools.
>
> Third, schools tend to emphasize abstract symbol manipulation, whereas work and other activities emphasize reasoning and actions connected with physical objects and events.
>
> Finally, while schools aim to teach general, widely usable skills and theoretical principles, success outside school depends on the development of situation-specific forms of competencies. (p. 5)

These four points suggest the need for skills similar to those identified in workplace research and in the SCANS report, which emphasizes the development of cooperative learning or group skills; and places less emphasis on learning abstract, domain-specific theories and facts and more on using this knowledge to reason about real-life problems; and more attention to how tools shape cognition in specific situations.

Contextual Learning

According to Raizen (1989) traditionally, vocational education, job internships, and such programs as career education and transition from school to work have had as their specific mission the preparation of youth and adults for the labor market. Generally, these programs were intended to provide students with broad skills, specific technical training, and attitudes that would allow them to obtain and maintain themselves in productive jobs. Rapid societal change and growing complexity of life and work are making predictions about the future more difficult. Because it is becoming increasingly difficult to predict specifically what workers will need to know and be able to do in the

future, their capacities to transfer what they know to previously unencountered problems and to learn on their own are becoming increasingly important. These changes require workers with a much broader range of competencies and skills than before. Many experts argue that the U.S. economy is undergoing a major transformation that can be characterized as follows:

> The extension of human muscle power which ushered in the industrial age is being paralleled by the extension of human brain power through the artifacts of the information revolution-computers, automation, and telecommunications.
>
> Furthermore, these technologies have created such a rapid information exchange that the economies of countries and even continents are becoming ever more closely linked, creating one global economy. The United States is still taking its first halting steps toward recognizing that it now must compete in a world market rather than relying solely on domestic consumption as being the engine of U.S. productivity. (p. 6)

These developments and expanded skill requirements will necessitate a reformulation of vocational education to more productive use of available learning technology integrated with the developing knowledge of the learner and effective learning contexts. Connecting school-learning to the real-life context of work is an essential element of vocational education. The simulation of work contexts in which students can acquire and practice both the basics and the specific skills thought to be necessary for a particular occupation is paramount. Raizen explains that this approach requires that the simulation or work experience offered through vocational education programs provides opportunities to address problem situations that are likely to be encountered later on in an actual job.

In *The Double Helix of Education & the Economy*, Berryman and Bailey model four characteristics of ideal learning (p. 90-93). (Figure 3)

Figure 3. Characteristics of ideal learning

CONTENT	SOCIOLOGY
Target knowledge for an ideal learning environment includes domain-specific conceptual, factual, and procedural knowledge and three types of strategic knowledge. Schools usually focus only on domain-specific content. However, strategic content is needed to operate effectively with domain-particular knowledge.	The learning environment should reproduce the technological, social, chronological, and motivational characteristics of the real-world situation in which what is being learned will be used.
SEQUENCING	**METHODS**
Learning should be staged so that the learner builds the multiple skills required in expert performance and discovers the conditions in which they can be generalized.	Teaching methods should be designed to give students the chance to observe, engage in, invent, or discover expert strategies in context.

Working together, content, methods, sequence, and sociology are an effective learning situation. The authors further explain that content includes higher-order thinking skills, taught in the context of a subject. Methods is the work relationship of teacher and students and their roles and responsibilities. Sequencing is the sequencing of learning, increasing the student's expertise and the broadening of knowledge. Sociology is the importance of reproducing the characteristics of the real-world situation so that what is being learned will be utilized. Encompassed in these characteristics are the technology, the social relationships and incentives, and the time frames that govern real-world tasks; content should be taught in the context of real-world problems.

Interestingly, this model parallels Bloom's model of school learning in the *Evaluation to Improve Learning* where Bloom described three interdependent variables that account for the greatest degree of variance in student learning. These variables are:

1. Cognitive entry behaviors - the extent to which the student has already learned the basic prerequisites to the learning to be undertaken.

2. Affective entry characteristics - the extent to which the student is or can be motivated to engage in the learning process.

3. Quality of instruction - the extent to which the instruction to be provided is appropriate to the learner. (p. 331-337)

Designed as a tool to aide the teacher in the preparation and evaluation of instruction, Bloom's taxonomy explains that abstract ideas and principals needed to be applied to particular or concrete situations in order for effective learning to take place.

Studies on *cognitive theory*, detailed by Thomas, Johnson, and Anderson (1992) lend support that learning is a process of knowledge construction rather than knowledge absorption and storage. They point out that people use what they already know in constructing new knowledge; and learning is closely related to the context in which it takes place. The learning of new ideas and the application of the ideas to specific situations in known as the *transfer of knowledge*. Thomas, Anderson, Getahun and Cooke (1992) define the transfer of knowledge as the capacity to:

1. see as relevant in a new context something that was learned in a different context,
2. apply what has been learned in another context to a new context, and;
3. apply old knowledge in a new context that is sufficiently novel to require learning of new knowledge. (p. vii)

This transfer of knowledge is the basis for integrated academic and vocational education. Work-related skills including critical thinking, cooperative problem solving, communication, information seeking, and a variety of other general skills are being increasingly demanded of workers, who must adapt to meet the challenges of an increasingly dynamic, competitive world market. Technological tools, such as computers, have the ability to help teach these kinds of skills (Lewis, 1992).

A new generation of educational technologies has been appearing. These have in common powerful capabilities for simulating work environments and guiding students through them interactively. These computer capabilities permit increased restructuring of the vocational classroom and curriculum to mirror workplaces more closely. Evolving computer technologies have the ability to provide contextualized instruction and comprehensive simulations that can enhance effective learning.

Although there are many uses for computers in vocational education, the study by Lewis pointed out that educators currently make only very limited use of the technological tools. Lewis stated "there is only limited use of, or experimentation with, these tools in the domain of public vocational education."

Summary of the Literature Review

As the literature pointed out, the need for computer literacy skills has met with controversy over the years. With the introduction of personal computers and growing technological integration in the workplace, the need for basic computer literacy skills has become more apparent. However, experts have been unable to agree on a standard definition of computer literacy. Many definitions were too narrow, providing students with limited skills and failed to give students an overall grasp of technology. Other definitions were so broad and generic that no specific skills were identified.

Changes in the nature of the workplace have called for a reform of our educational system. Recent federal legislation has identified basic skills needed for students to be employable in the job world of the future. The SCANS report, STWOA and Goals 2000 all cite technology skills as one of the several competencies students must master in order to be employable now and in the future.

In order to prepare students with the workplace skills necessary, schools must place a new emphasis on the development of teaching generic skills in contextualized formats that can be applied and related to real-life situations. This will necessitate a reformulation of vocational education to more productive use of learning technology integrated with the developing knowledge of the learner and effective learning contexts. Many educational experts agree that effective learning takes place when the content being taught closely simulates the workplace or task for which the student is preparing.

Many new skills are being demanded of workers, who must adapt to meet the challenges of a competitive world market. Technological tools, such as computers, have the ability to help teach these skills. Educational technologies have the unique ability for simulating work environments. These capabilities facilitate restructuring of the vocational classroom and curriculum to mirror workplaces more closely. Evolving computer technologies have the ability to provide contextualized instruction and comprehensive simulations that can enhance learning and further facilitate technological literacy.

Chapter Three

Research Design and Procedures

Theoretical Base of the Study

Theoretically, schools have the responsibility of preparing students for entry into the workforce. However, recent reports by the Departments of Labor and Education have declared that most students leaving high schools with a valid diploma do not possess the basic skills necessary to obtain and hold a job.

Technological literacy was one of these basic skills identified in both the SCANS report and the School-to-Work Opportunities Act. For the purpose of this study, computer literacy, one aspect of technological literacy, has been explored.

To test the theory, the study was designed to identify and measure the degree to which written student computer literacy plans have existed in regular day high school curriculum. Respondents were randomly selected principals in secondary schools. A survey instrument was used to gather data for establishing the degree to which student computer literacy had been addressed at the secondary level. Thirty high schools were contacted (N=30), of those, 29 participated in the study (n=29).

Research Questions

Five research questions were addressed by the study:

1. To what extent do written plans for student computer literacy exist in the high schools and districts in the Los Angeles and San Bernardino counties?
2. What is the working definition of computer literacy held by the State of California?
3. To what degree have high schools and district offices identified the components necessary to prepare students to become computer literate?
4. What computer hardware are the schools purchasing and what criteria and input sources are considered in the selection of that equipment?
5. How are high schools measuring student outcome objectives to assess the effectiveness of their plan?

Questionnaire

A questionnaire (see Appendix B) was used to collect data for the study. The questionnaire was designed as a data gathering instrument to obtain information from high school principals, assumed responsible for designing, implementing, utilizing, managing, and optimizing the integration of student computer literacy curriculum in regular day high schools.

The questionnaire consisted of four sections: Demographic information of the participants, District Data which encompassed information and factors affecting a

district-wide plan, School Data focused on information and factors affecting each individual high school and Other Data which gathered specific information from the entire sample.

Population Sample and Description

The selected population was a cross-section of secondary principals from Los Angeles and San Bernardino counties in Southern California. Of the 30 principals contacted (N=30), 29 participated in the study. Respondents were principals between the ages of 30 and 60. Respondents had between four and eight years of principalship experience and the majority (45%) had 13 or more years of teaching experience. All principals had at least a Masters degree in a field related directly or indirectly to education.

Procedures

Data were collected through telephone interviews with principals from randomly selected schools. Principals were verbally read each question in the questionnaire and were asked to select appropriate responses. The data were then coded and entered into a statistical software package on a personal computer. A comparative analysis was performed. Frequencies and percentages were computed to indicate differences and similarities among groups of principals, districts and schools regarding perceptions of

student computer literacy curriculum. Data from open-ended responses were summarized and categorized.

Methods of Treatment of Data

For statistical purposes, a quantitative survey model was selected to answer the research questions. The questionnaire was designed to solicit respondents' demographics and measure the degree to which computer literacy programs have existed in the selected regular day high schools. The survey was administered by telephone interviews during April and May of 1994. Thirty principals (N=30), one per district, were selected at random from regular day high schools in Los Angeles and San Bernardino counties. Twenty-nine completed questionnaires were coded and designed to obtain specific information tied to each major research question. Data were entered into a personal computer and analyzed using a statistical software package. A comparative analysis was performed. Frequencies and percentages were computed to indicate differences and similarities among groups of principals, districts and schools regarding perceptions of student computer literacy curriculum. Data from open-ended responses were summarized and categorized.

Validity

A pilot study was designed to validate the research instrument. A small sample of principals (n=8) were chosen at random for the pilot and were not included in the study population.

After the pilot study was completed, modifications to both questions and response choices were made to increase the usefulness of the instrument. Specifically, wording in several questions was changed to remove ambiguity and promote better understanding and intent of the questions. Some questions were modified to reflect more effective scoring methods. These changes increased the validity of the overall instrument.

Chapter Four

Findings and Discussion

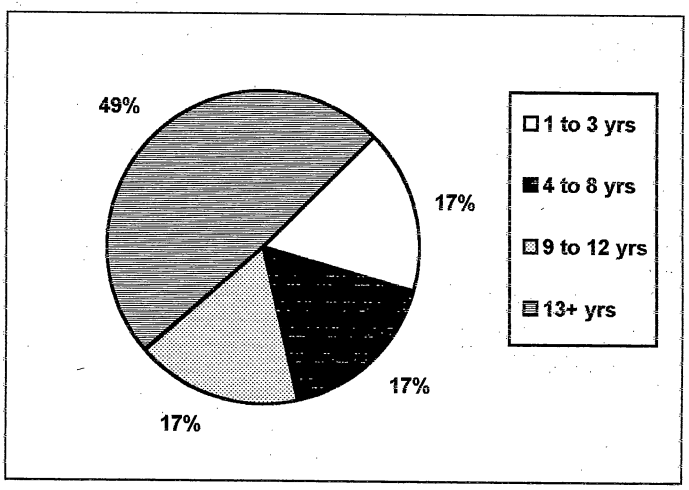
Introduction

The research findings were tabulated from the Demographics, District, School and Other Data sections of the survey questionnaire (see Appendix B). Each research question was addressed, matched against the findings and discussed.

Demographic Findings

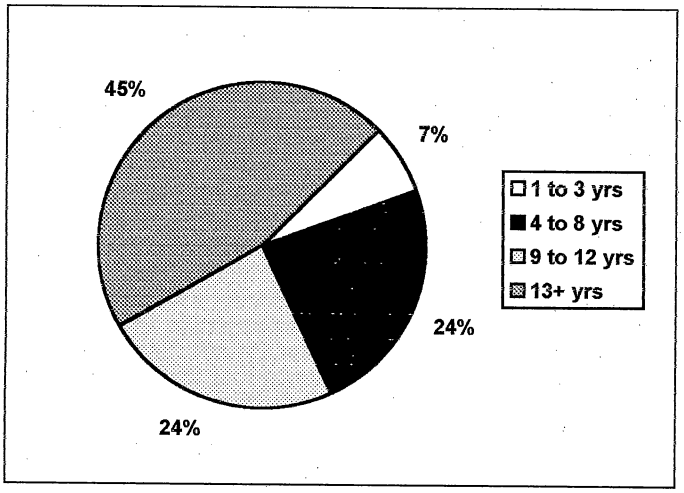
Survey questions in the Demographics section were used to construct a demographic profile of the study population. Data were applicable to all respondents. Percentages may total more or less 100% due to rounding. The respondent population of N=29 indicated that a majority of the respondents (49%) had held a principal's position between 4 to 8 years, as compared to 17% in the position between 1 and 3 years, 9 to 12 years, or 13 or more years (see Figure 4).

Figure 4. Years as Principal



Forty-five percent of respondents indicated they had over 13 years of teaching experience. Twenty-four percent had between 4 to 8 years, or 9 to 12 years, while only 7% had 1 to 3 years of teaching experience (see Figure 5).

Figure 5. Years Teaching

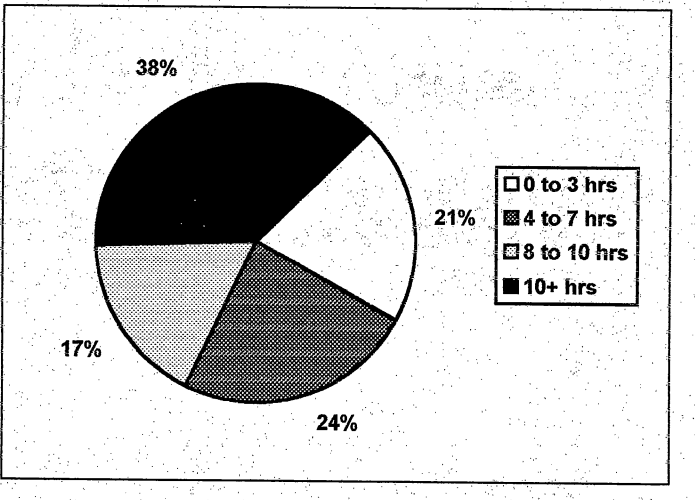


The majority of respondents (66%) held master's degrees while 34% held doctoral degrees. Educational majors among the respondents varied. Seventy-two percent received their degree in Educational Administration, 7% each in either Secondary Education or Counseling. Three percent each received degrees in one of the following: Psychology, Personnel, Math, or English.

Eighty-three percent of respondents said they had a computer in their office for their own use. Of those computers, 50% were Macintoshes, 42% were IBM/Clones, and 8% were Apple IIs. Seventeen percent of principals did not have an office computer for his/her own use.

Of principals who had office computers, 38% used them more than 10 hours per week. Twenty-one percent used them between 4 and 7 hours per week, 17% used them between 8 and 10 hours per week, and 24% used the computers 3 hours or less per week (see Figure 6).

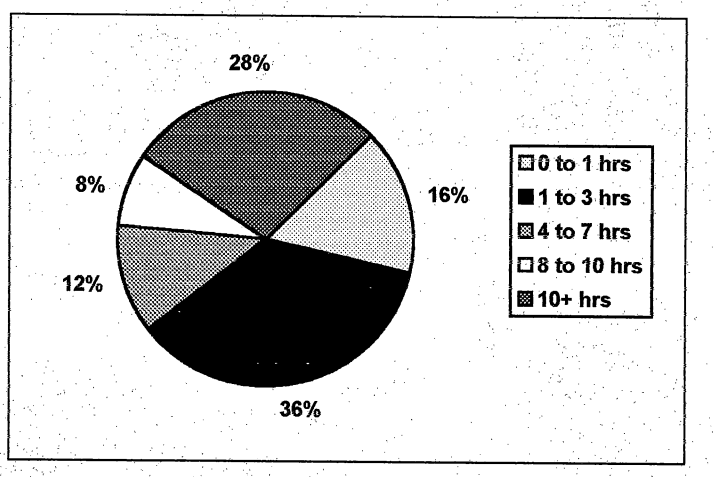
Figure 6. Office computer use hours per week



Respondents indicated that 83% had computers at home for their use. Of these, 36% had a Macintosh and the same percent had an IBM/Clone. Apple IIs were in 28% of the households.

As expected, principals spent less time on the home computers. The majority (36%) reported they spent between 1 and 3 hours a week on the computer. Twenty-eight percent said they spent 10 or more hours per week, 16% spent one or less, 12% spent 4 to 7 hours, and 8% spent 8 to 10 hours per week (see Figure 7).

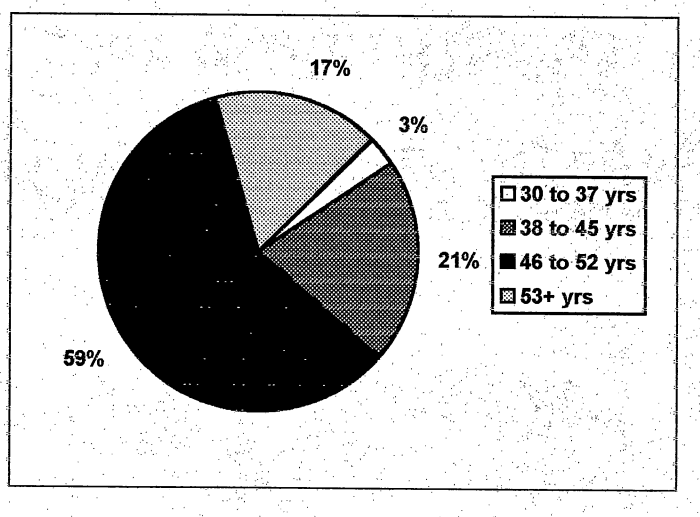
Figure 7. Home computer use hours per week



Asked to rate their own level of computer proficiency, 42% of respondents rated themselves as either level one (42%) or level two (42%) users. Ten percent rated themselves as not knowledgeable (level 0), and only 7% rated themselves as advanced (level 3).

Most principals surveyed (59%) were between 46 and 52 years of age. Twenty-one percent were 38 to 45, 17% were 53 and older, and only 3% were between 30 and 73 years of age (see Figure 8).

Figure 8. Principals by Age



District Findings

Survey questions in the District Data section were used to construct a profile of the study population's perceptions of the district's written technology plan for student computer literacy. The following data were applicable to all respondents that indicated the District had a written plan for student computer literacy and included the majority (69%) of the respondent population of (N=29).

Sixty-nine percent were then asked to indicate which of the identified competencies were included in the district plan. For purposes of tracking and anonymity, all schools participating in the study were assigned a code number. Schools were

identified by code number. Data indicated that of 20 respondents (n=20), the following frequencies applied: (see Table 1).

Table 1. Competencies Included in District Plan (n=20)

	Competencies in District Plan						
Schools by Code	A	B	C	D	E	F	G
01	X	X	X	X	X	X	
03	X	X	X	X			
04	X		X	X			
05	X		X	X	X		
06	X	X	X	X	X	X	
09	X	X	X	X		X	
11							X
12	X	X	X	X	X		
13							X
14	X				X		
15							X
16	X	X	X	X	X		
19	X	X	X	X	X		
20	X	X	X	X	X		
22	X	X	X	X	X		
23							X
26	X	X	X	X	X	X	
27	X	X	X	X	X	X	
28	X	X	X	X	X		
29	X	X	X	X			
Totals	16	13	15	15	12	5	4

A	Promotes a basic understanding of how a computer works (e.g., encodes, stores and retrieves information).
B	Provides basic skills for interacting with a computer to access stored information (e.g., library skills).
C	Familiarize students with various applications of available software (e.g., vocational, educational, entertainment and etc.).
D	Provide basic skills for using computers to run available software.
E	Develop awareness of the computer's impact on society (e.g., technological advancement).
F	Develop programming skills.
G	Don't know.

The same 20 respondents were asked to indicate what student performance objectives the District identified in its plan (see Table 2).

Table 2. District Student Performance Objectives (n=20)

	District Student Performance Objectives					
Schools by Code	A	B	C	D	E	F
01	X	X	X	X	X	
03	X	X	X			
04	X		X			
05						X
06						X
09	X	X	X		X	
11						X
12	X	X	X	X		
13						X
14						X
15						X
16	X	X	X	X		
19	X	X	X	X		
20	X	X	X	X		
22	X	X	X	X		
23						X
26	X	X	X	X	X	
27	X	X	X	X	X	
28	X	X	X	X	X	
29	X	X	X		X	
Totals	13	12	13	9	6	7

A	Encode, store and retrieve information
B	Access stored information
C	Learn and utilize various software applications
D	Define technology's emerging impact on society
E	Demonstrate higher level problem solving
F	Don't know

Only 3 of the 20 principals indicated that the district specified a hardware platform preference. Of the three, two specified the Macintosh platform, and one specified IBM/Clone platforms.

These principals identified criteria considered in the selection of platform specifications. Respondents were asked to select all criteria that applied (see Table 3):

Table 3. District Selection Criteria (n=3)

	District Selection Criteria							
Schools by Code	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
15	X							
20			X	X		X		
29							X	
Totals	1	0	1	1	0	1	1	0

A	Cost	E	Curriculum Objectives
B	Personal Experience	F	Compatibility
C	User Friendliness	G	Industry Standard
D	Available Support	H	Staff Expertise

Input sources used in the selection of platform specifications by these three districts were as follows: (see Table 4).

Table 4. District Sources of Input (n=3)

	District Sources of Input					
Schools by Code	**A**	**B**	**C**	**D**	**E**	**F**
15		X				
20			X			
29		X				
Totals	0	2	1	0	0	0

A	Parent Group	D	Private Consultant
B	Staff Recommendation	E	Advisory Group
C	District Consultant	F	Don't know

School Findings

Survey questions in the School Data section were used to construct a profile of the population perceptions of the school's written technology plan. The following data were applicable to all respondents that indicated the School had a written plan for computer literacy. This included the majority (59%, n=17) of the respondent population of N=29.

The 59% were then asked to indicate which of the identified competencies were included in the school's plan. Data indicated that of 17 respondents (n=17), the following frequencies applied (see Table 5):

Table 5. Competencies Included in School Plan (n=17)

	Competencies in School Plan						
Schools by Code	A	B	C	D	E	F	G
01	X	X	X	X	X	X	
04	X	X	X	X	X		
05	X		X	X	X	X	
06	X	X	X	X	X		
07	X	X	X	X	X	X	
09	X	X	X	X		X	
12	X	X	X	X	X		
15							X
16	X	X	X	X	X		
17	X	X	X	X			
18	X	X	X	X	X		
19	X	X	X	X	X	X	
20	X	X	X	X	X		
22	X	X	X	X	X		
23	X	X	X	X	X		
25	X	X	X	X			
26	X	X	X	X	X		
Totals	16	15	16	16	13	5	1

A	Promotes a basic understanding of how a computer works (e.g., encodes, stores and retrieves information).
B	Provides basic skills for interacting with a computer to access stored information (e.g., library skills).
C	Familiarize students with various applications of available software (e.g., vocational, educational, entertainment and etc.).
D	Provide basic skills for using computers to run available software.
E	Develop awareness of the computer's impact on society (e.g., technological advancement).
F	Develop programming skills.
G	Don't know.

The same 17 respondents were asked to indicate what student performance objectives the School identified in its written plan for student computer literacy (see Table 6).

Table 6. School Student Performance Objectives

(n=17)

	School Student Performance Objectives					
Schools by Code	A	B	C	D	E	F
01	X	X	X	X	X	
04	X	X	X			
05	X	X	X	X	X	
06						X
07	X	X		X	X	
09	X	X	X		X	
12	X	X	X	X		
15						X
16	X	X	X	X		
17	X	X	X			
18	X	X	X	X	X	
19	X	X	X	X	X	
20	X	X	X	X		
22	X	X	X	X		
23	X	X	X	X		
25	X	X	X	X		
26	X	X	X	X	X	
Totals	15	15	14	12	7	2

A	Encode, store and retrieve information	D	Define technology's impact on society
B	Access stored information	E	Demonstrate higher level problem solving
C	Learn and utilize various software applications	F	Don't know

Data indicated the length of the school's review cycle for the written technology plan varied greatly. Sixty-one percent reviewed the plan once a year or on an on-going basis, 17% reviewed it every three years, the same percent reviewed it every 5 years; and 7% did not know how often their school's plan was reviewed.

Principals were asked what measurement was used to show student outcome objectives were being met. Forty-five percent indicated staff assessment, 31% used

portfolio evaluations, 17% utilized standard tests; and only 10% pursued follow-up data from employers (see Table 7).

Table 7. School Measurements for Outcome Objectives (n=17)

	Standard Tests	Data from Employers	Portfolio Evaluation	Staff Assessment
Schools by Code				
01	X		X	
04		X		X
05				X
06			X	X
07	X			X
09				X
12				X
15	X		X	
16			X	
17		X	X	
18			X	
19	X			X
20			X	X
22			X	X
23				X
25		X	X	
26	X			X
Totals	5	3	9	11

Only six (n=6) of the 17 principals indicated the school specified a hardware platform preference. Of the six that did, 67% (n=4) specified the Macintosh platform, and 33% (n=2) specified IBM/Clone platforms.

Criteria considered in the selection of the platform specification by these six schools as indicated by the principals was as follows (see Table 8):

Table 8. School Selection Criteria (n=6)

	School Selection Criteria							
Schools by Code	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
06								X
15					X		X	
16	X		X			X		
18			X	X	X			
19					X		X	
20			X	X		X		
Totals	1	0	3	2	3	2	2	1

A	Cost	E	Curriculum Objectives
B	Personal Experience	F	Compatibility
C	User Friendliness	G	Industry Standards
D	Available Support	H	Staff Expertise

Input sources used in the selection of platform specification by these six schools were identified in Table 9.

Table 9. School Sources of Input (n=6)

	School Sources of Input					
Schools by Code	**A**	**B**	**C**	**D**	**E**	**F**
06		X	X			
15					X	
16		X	X			
18		X			X	
19					X	
20					X	
Totals	0	3	2	0	4	0

A	Parent Group	D	Private Consultant
B	Staff Recommendation	E	Advisory Group
C	District Consultant	F	Don't know

Other Findings

Survey questions in the Other Data section were used to construct a profile of the most recent computer acquisition and the elements taken into consideration before the acquisition. The following data were applicable to all respondents surveyed N=29.

When asked to indicate approximately when the last computer hardware purchase took place, 76% of respondents indicated their school purchased within the last 3 months. Fourteen percent last purchased hardware between 3 and 6 months, 7% between 6 and 12 months; and 3% indicated it had been a year or more since their school's last purchase.

Of the purchases made, 76% purchased Macintoshes, 21% selected IBM/Clones, and 3% purchased Apple IIs (see Figure 9).

Figure 9. New purchases

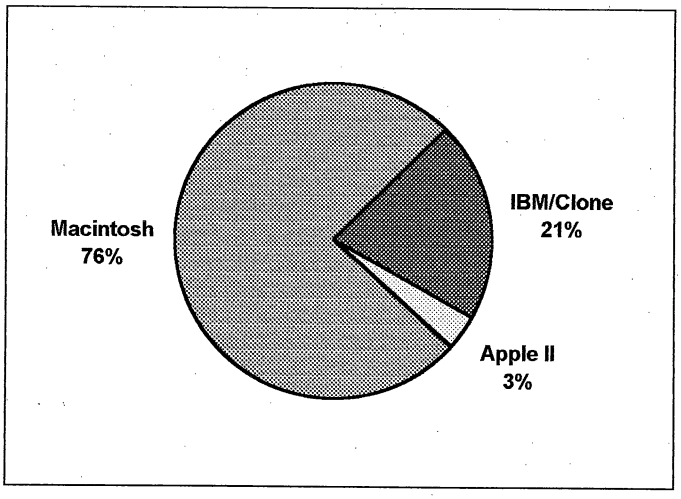


Table 10 includes criteria considered for the selection of the computer platform that was purchased.

Table 10. New Equipment Selection Criteria (n=29)

	New Equipment Selection Criteria								
Schools by Code	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
01									X
02					X				
03				X					
04	X					X			
05			X						
06								X	
07	X			X	X		X	X	
08			X						
09			X			X			
10	X		X					X	
11	X								
12						X			
13					X	X	X		
14			X			X			
15					X		X		
16	X				X	X			
17					X				
18			X	X	X				
19					X		X		
20			X	X		X			
21				X		X			
22					X				
23						X			
24	X		X						
25			X	X				X	
26	X								
27			X						
28					X				
29							X		
Totals	7	0	10	6	10	9	5	4	1

A	Cost	F	Compatibility
B	Personal Experience	G	Industry Standards
C	User Friendliness	H	Staff Expertise
D	Available Support	I	District Mandate
E	Curriculum Objectives		

Input sources used in the selection of the hardware platform are included in Table 11.

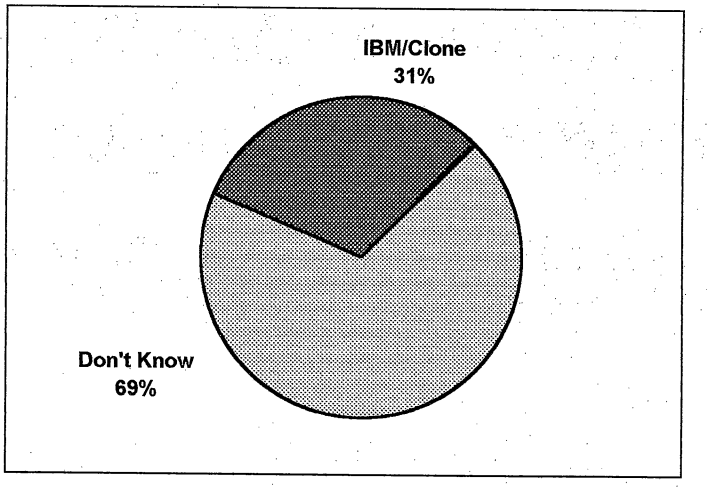
Table 11. School Sources of Input (n=29)

	School Sources of Input					
Schools by Code	**A**	**B**	**C**	**D**	**E**	**F**
01			X			
02		X	X			
03				X		
04		X				
05		X				
06		X	X			
07		X				
08		X				
09		X				
10		X				
11		X	X			
12		X				
13			X	X		
14		X	X			
15					X	
16						X
17		X				
18		X			X	
19					X	
20					X	
21		X			X	
22		X		X		
23		X	X			
24		X	X			
25		X	X			
26		X	X	X		
27		X				
28		X				
29			X			
Totals	0	21	11	4	5	1

A	Parent Group	D	Private Consultant
B	Staff Recommendation	E	Advisory Group
C	District Consultant	F	Don't know

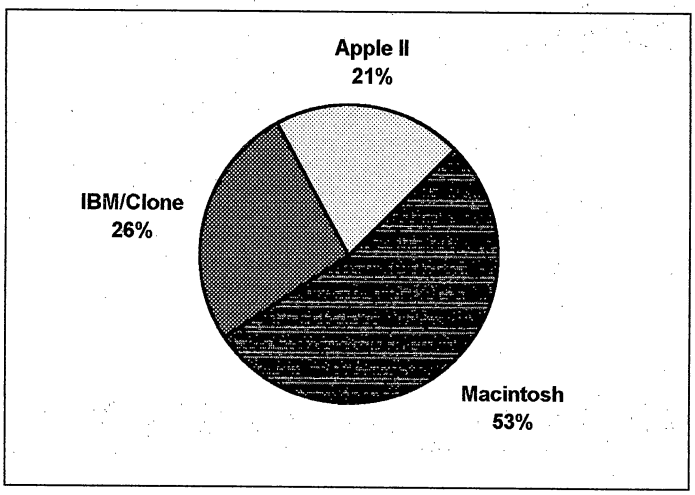
Principals were asked to indicate what computer platform is currently used by the majority of corporations in their area. Sixty-nine percent (n=20) responded that they did not know, and 31% (n=9) indicated they thought it was an IBM platform (see Figure 10).

Figure 10. Computer Platform of Area Corporations



When asked what computer platform was most represented currently at their school, 62% (n=18) of the principals responded they had primarily Macintoshes 31% (n=9) responded IBM/Clones; and only 7% (n=2) had primarily Apple IIs (see Figure 11).

Figure 11. Computer Platform Most Represented at School

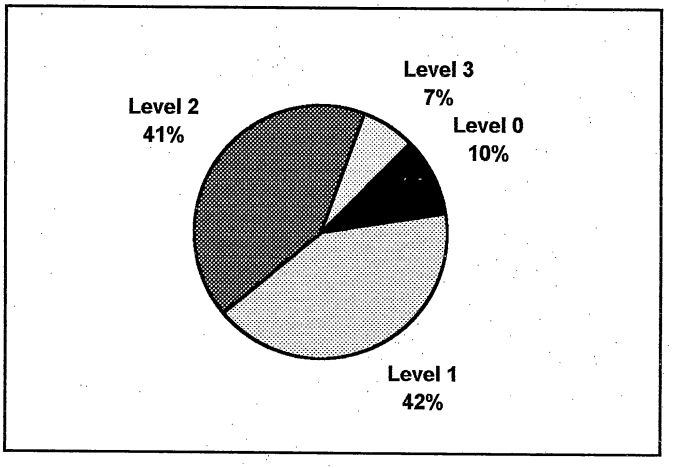


Discussion of the Findings

Population demographics.

Information on the study population's demographics came from the Demographics section of the questionnaire. Based on the findings, principals were highly educated, holding either masters or doctoral degrees. Eighty-three percent (n=24) had a computer in the office available for his/her own use. Of these, 57% (n=14) were using Macintosh or Apple IIs over IBM/Clones (42%, n=10). The same percentage (83%) of principals who had office computers, had computers at home for personal use. Data indicated the Macintosh/Apple IIs (64%, n=15) were favored over IBM/Clone computers. The data implied there was a correlation between the computer platform the principals used at the office and at home. Furthermore, principals who used Macintoshes and Apple IIs rated themselves lower in computer proficiency than principals who used IBM/Clone computers, which was interesting since all principals were highly educated, but rated themselves mostly as computer novices, (93%) between level 0 and level 2 (see Figure 12).

Figure 12. Principal's Proficiency Ratings



From the findings, it can be inferred that principals are likely to recommend and purchase computers for which they feel most comfortable using. However, the data suggests that principals, although highly educated, are not likely to be technologically literate.

Research question 1.

To what extent do written plans for student computer literacy exist in the high schools and districts in the Los Angeles and San Bernardino counties? An indication of the study population's perceptions came from the variables in question 1 of District Data and question 2 of School Data (see Appendix B). The variables in 1.A through 1.B and 2.A through 2.D indicated to what extent the written plan for student computer literacy had been defined. Data indicated only 69% (n=20) of the districts had a written computer literacy plan. Some principals indicated their district was in the

process of writing a plan at the time of the interview. Of the districts with plans, 80% (n=16) identified which competencies were included in the plan (see Table 1) and 65% (n=13) identified student performance objectives (see Table 2). However, these numbers may have been inflated due to the Hawthorne effect.

At the school level, only 59% (n=17) indicated they had written plans for student computer literacy. Of those, 88% (n=15) identified which competencies and student performance objectives were included in the plan (see Tables 5 and 6). The data implies that districts and schools are giving only limited consideration and planning toward computer literacy programs. The data suggests that more time, effort, and planning was allocated for the procurement of equipment than to the identification of a literacy plan and outcome objectives.

Furthermore, of the schools with written plans, only 61% reviewed the plan yearly, or on an on-going basis. Forty-one percent reviewed their written plans between 3 and 5 years. These numbers are significant because technology is a dynamic industry and changes quickly. What is state-of-the-art now can be obsolete in a year. The data suggests that almost one half of the schools with written plans are possibly following out-moded, obsolete plans. This implies that their plans for student computer literacy are likely to be ineffective.

Research question 2.

What is the working definition of computer literacy held by the State of California? This information was researched by telephone calls to county offices for San Bernardino and Los Angeles counties, calls to the California State Office of Education, local offices of State Assemblymen and Congressmen, and the State Superintendent of Education. The consensus reached there existed "no working definition of computer literacy" for California held by these agencies. This implied that each district and school has been left to develop its own definition and guidelines concerning computer literacy. Without state guidelines there exists a vast inconsistency of computer literacy programs between schools and districts, therefore contributing to the lack of accountability. In other words, in the absence of state guidelines, schools cannot be held accountable for lack of structured, state-of-the-art computer literacy programs.

Research question 3.

To what degree have the high schools and district offices identified the components necessary to prepare students to become computer literate? To determine the degree to which these components were identified, District Data questions 1.A through 1.B and School Data questions 2.A through 2.D listed variable components that respondents indicated were or were not identified in their plan for student computer literacy (see Appendix B). The maximum total variables possible would be the

indication of all variables listed in each question. Only four principals indicated their district plan included all of the competencies identified by this researcher (see Table 1). The same number of principals (n=4) identified all five of the performance objectives as being included in their district plan (see Table 2). Significantly, four principals did not know what competencies were included, and seven did not know what performance objectives had been identified by the district.

Numbers were just as low by individual school. Only three (n=3) principals indicated all competencies listed as included in their school plan (see Table 5). Four (n=4) principals indicated all of the performance objectives as included (see Table 6). One principal did not know what competencies were included and two principals were unaware of the performance objectives included in their school plan.

The data suggested that schools are giving little consideration to the specific planning of the student computer literacy programs within their districts and schools. Data indicated that necessary competencies have not been identified, nor have specific performance objectives in the majority of the schools surveyed. This implied many of the programs are likely to be ineffective.

Research question 4.

What computer hardware are the schools purchasing and what are the criteria and input sources considered in the selection of that equipment? In the District Data section C, School Data section E, and Other Data section 3, questions were

designed to specifically identify the type of computer hardware schools have purchased, and the criteria and input sources used to make their selections (see Appendix B). Respondents were asked to indicate all criteria and sources that applied to their school. This accounts for multiple variables selected on some of the questions.

Overwhelmingly, principals indicated that district and school plans did not specify computer hardware preferences. Instead, it was implied that this was a decision made at the time of purchase and not given consideration at the time of the plan. The few districts and schools that did specify preferences (between 20 and 30%) chose Macintosh platforms over IBM/Clones almost three to one. These numbers supported the earlier theory that principals tended to recommend and purchase what they themselves were comfortable using in their office or home.

Of the 3 schools who indicated they had a district plan that specified a hardware preference, one district based its selection criteria on *cost*; the second district based its selection criteria on a combination of: *user friendliness, available support, and compatibility* (see Table 3). Only one principal indicated that the district used *industry standard* for a selection criteria.

The sources of input sought by the districts for the selection of hardware were very narrow. Two respondents said their districts sought input from staff members *(staff recommendation*) and one sought input only from a *district consultant* (see Table 4).

Individual schools with written plans considered more criteria, choosing a variety of variables (see Table 8). Selection criteria with the most frequency (fifty percent, n=3)

were *user friendliness* and *curriculum objectives*. Second most selected were *available support, compatibility* and *industry standards* (n=2). *Cost* and *staff expertise* were last in frequency (n=1). Only two schools indicated selection criteria of both *curriculum objectives* and *industry standards*. The data implied that more emphasis was placed on the friendliness of the machine than on its intended use or purpose.

Input sources sought by schools with written plans (see Table 9) were *advisory group* (n=4), *staff recommendation* (n=3) and *district consultant* (n=2). This data suggested that schools have formed advisory groups to assist them in decision making. However, this may or may not be true. Traditional advisory groups should include representatives from staff, parents, students and local industry. Many of the schools surveyed indicated their advisory groups were made up of staff, some also included parents. Findings implied that few advisory groups included local industry representatives. The question of who was represented on the advisory group was not included in the survey, but would have been appropriate in order to collect more accurate information.

In the Other Data section, schools were asked what selection criteria and sources of input were used for the selection of their most recent equipment purchase (see Appendix B). Of the survey population (N=29), schools based their purchases primarily on *user friendliness* (n=10), *curriculum objectives* (n=10) and *compatibility* (n=9). Only five schools considered *industry standards* as a criterion and only four considered both *industry standards* and *curriculum objectives* (see Table 10).

Staff recommendation was the most frequent source of input (n=21) used by the schools (see Table 11). Second was *district consultant* (n=11) and *advisory group* input was only chosen by five of the schools. This means that an overwhelming amount of schools are seeking the input of people who are not qualified to advise them on the selection of appropriate hardware.

Not surprisingly, 69% (n=20) of the principals said they did not know what computer platform was currently in use by the majority of corporations in their area (see Figure 10). Thirty-one percent (n=9) said they thought it was an IBM/Clone platform. Yet, of the recent purchases made (see Figure 9), 76% purchased Macintoshes (n=22) and only 21% purchased IBM/Clones.

These data tell an alarming story. High schools, who have the responsibility of preparing youth with the computer literacy skills necessary to enter the workforce, are selecting computer equipment based on criteria that has little to do with outcome objectives. Also, principals are seeking equipment recommendations from people who are generally not qualified to provide them. Even more alarming is the fact that principals admit to not being aware of what is being used in the industry, yet they continue to authorize the purchase of more equipment with little consideration as to its intended purpose.

Research question 5.

How are high schools measuring the student outcome objectives to assess the effectiveness of their plan? In School Data question 2.D, respondents were asked to identify what evaluation methods were being used to measure the outcome objectives (see Appendix B). Principals were asked to indicate all variables that applied to their school.

The majority of schools (45%, n=13) were still relying on *staff assessment*. Thirty-one percent were participating in *portfolio evaluations* (n=9), 17% (n=5) were using *standardized tests* and only 10% (n=3) measured *follow up data from employers* (see Table 7). These numbers are significant. This data supported the conclusion that little consideration is given to the needs of the employment community or the needs of the students in preparing them for workplace competency.

Summary of Findings and Discussion

The findings suggested that neither districts nor individual schools have devoted much time or attention to planning, identifying, or implementing the essential elements necessary to prepare students to become computer literate. Although principals expressed an awareness of the growing need for computer literacy skills, less than 60% of the high schools had written plans for student computer literacy. Of further concern is the fact that the California State Office of Education has not adopted a working definition of computer literacy. This implies that each district and school is left to develop its own definition and guidelines concerning computer literacy. Without state guidelines, schools cannot be held accountable for lack of structured, state-of-the-art computer literacy programs.

It is no surprise then, that schools have not clearly identified the necessary competencies and performance objectives needed for students to become computer literate. Without a map to follow, it is difficult to chart a course to a destination.

In regard to the selection of computer hardware, findings indicated that more emphasis was placed on user-friendliness over industry standards, or any of the other listed criteria. Most decisions regarding the purchase of new equipment were made with the input from staff instead of industry personnel, further supporting the separation of education and workplace preparation.

Furthermore, principals indicated they were unaware of the types of computers being used by the corporations in their area, but thought surrounding corporations were

probably IBM/Clone based. Yet, they chose to purchase Macintoshes over IBM/Clones almost three to one.

Lastly, the majority of principals indicated they were still relying on staff assessment instead of employer follow-up as a measurement of student outcome effectiveness.

Clearly, most of the high schools represented in the study, have missed the bottom line objective: they are not preparing the youth with the computer literacy skills necessary for workplace success. Instead of leaving high school with the needed vocational computer skills, students have only watered-down skills with little relevance, if any, to today's workplace.

Computer literacy skills for the workplace can best be judged by employers. Schools that want to build strong computer literacy programs recruit industry representatives for their advisory committees; purchase appropriate equipment based on intended purpose, industry standard and curriculum, identify the necessary components, skills and outcomes, and evaluate the program based on the feedback from employers. The majority of schools represented in the study have not only failed to accomplish the preceding,, in most cases, the schools totally disregarded these key elements.

Chapter Five

Conclusions and Recommendations

Conclusions

Investigation of the data concluded that computer literacy programs in the selected high schools of Los Angeles and San Bernardino counties are greatly lacking in structure and are likely to be ineffective in preparing students with computer literacy skills necessary to perform effectively in the workplace. Findings indicated that of the schools who participated in the study, few had written plans that identified specific competencies and student performance objectives necessary for students to become computer literate; or measured outcome objectives by follow-up data from employers.

Based on the findings, it could be inferred that schools allocated more time, resources and planning, to the acquisition of new equipment than to the identification of appropriate equipment matched to workplace related outcome objectives. This implied that much of the equipment schools have purchased in recent years has been inappropriate for the skills being taught, leading to ineffective training and ill-prepared job seekers.

It was also found that schools generally selected computer equipment primarily on its user friendliness instead of its intended purpose or standard in the workplace. Results of the surveys suggested that schools sought recommendations mostly from staff members, people who were basically not knowledgeable about workplace technology or industry standards and were generally not qualified to select appropriate equipment.

These staff members tended to select equipment on the basis of what was going to be easiest for them to learn and use, not based on industry guidelines, curriculum objectives or employer input. As a result, students were leaving school with computer skills that have little relation, if any, to what was needed for the workplace. Raizen (1989) pointed out:

> Not surprisingly, students emerge from school handicapped in the workplace where they face a changing world of complex and evolving technologies demanding the use of problem solving skills that they have never had the opportunity to learn. To counter these young workers' seeming incompetence, industries develop turn-key operations and step-by-step manuals that further disable students/workers by removing any possibility of their developing in-depth understanding of the problem solving processes involved in their particular work assignments. (p. 24)

Unfortunately, survey data supported that schools are further disabling students by providing these "turn-key" computers at the classroom level. Recent technological developments in computer software, such as Graphical User Interfaces (GUIs), are aimed at making computers easier to use, masking the operation the computer actually performs, with the result that what is being instilled in human consciousness as cognitive structure and content is invisible to the user. Troll (1989) explained that when users do not know what happens at the level beyond mice and menus, the result will be an increasing gulf between the knowledgeable and the rest. Troll further argues that "user friendliness" of a system when increased, may in turn widen the gap between what the user perceives and the underlying operation of the computer. "Teaching only basic skills on user-friendly computers does not constitute academic computing. Rather, this

approach cultivates computer literacy at a craft level similar to the medieval copyists who often could not read what they copied" (p.57).

Overall findings suggested that user-friendly computers (with GUIs) were the most represented platform for student use. This implied that students were learning what was easiest to teach, instead of what was appropriate based on workplace standards.

Clearly, from the findings, it can be concluded that computer literacy programs currently in existence are largely ineffective, or mediocre at best. In fact, 27 of the 29 schools studied showed only minimal regard for computer literacy needs of students and employers. This apparent disregard raises some serious questions. If schools do not serve the needs of students and employers, then who are they serving and what is their role?

Further investigation of the data revealed some alarming issues. Through the findings, principals indicated they were unaware of the computer platforms used in area corporations, or at least thought the corporations were IBM\Clone based. Yet, as principals indicated, they mostly chose to purchase unrelated platforms for student use, confirming the continued division of school and work at the high school level.

Significantly, this suggests that schools have not yet made the important connection of school-learning to the real-life context of work. California's State Department of Education may have contributed to this continued dichotomy by not providing state guidelines for student computer literacy programs. Lack of guidelines at the state level has resulted in little effort at the district and school levels to assume responsibility for the research and development of effective computer literacy programs that would ensure students appropriate work related skills.

Recommendations

Blue ribbon committee.

It is therefore necessary that the California State Department of Education, research and develop guidelines for districts and high schools to operationalize computer literacy programs. In order to develop guidelines, it will be necessary to create a special "blue ribbon" committee to identify the computer literacy skills needed by employers. This committee should include representatives from industry (public and private), along with specialists in education from various areas of the state. However, the majority of representatives on the committee need to be directly tied to industry.

This "blue ribbon" committee could determine industry needs and advise the California Department of Education on the competencies, performance outcomes and appropriate equipment and materials needed for students for workplace skills preparation.

Because technology is a dynamic structure and changes rapidly, the "blue ribbon" committee would have the responsibility of reviewing industry needs on an on-going basis and updating the guidelines yearly at a minimum. This would enable schools to respond in a more timely manner to the needs of industry and would provide students with "leading edge" instruction, thereby making it easier for students to find employment. Furthermore, guidelines would provide schools with updated information on necessary skills. This would decrease the amount of obsolete and ineffective

programs offered by schools. Since schools would be informed of current industry needs and trends, resources could be allocated more effectively.

Federal legislation.

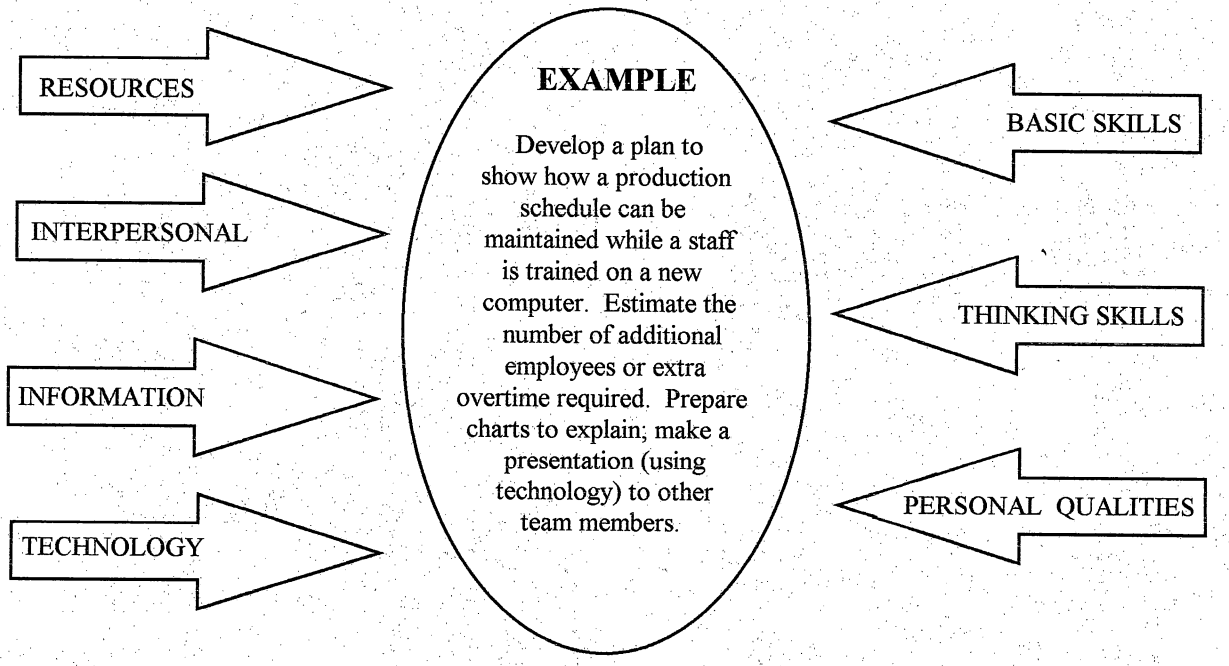
Unfortunately, recent federal legislation such as the SCANS report, STWO Act, and Goals 2000 referred to technology skills in very generalized, non-specific terms. Although the main intent of the legislation was to provide students with a smooth transition from school to employment, the legislation makes no specific mention of matching the equipment, materials, competencies and outcome objectives to the workplace. Also, computer technology in the workplace has evolved to the point of being integrated into all aspects of workplace tasks. Computers are no longer isolated tools used by the few. Raizen (1989) noted that instruction all too often takes place through the practice of isolated subtasks in which the emphasis is upon satisfactory repetitive performance rather than on use in appropriate contexts.

For schools to provide effective workplace preparation, computer technology will need to be integrated into all aspects of the curriculum. This will provide a simulated environment that fosters the use of technology as a tool, similar to the workplace environment (see Figure 13).

FIGURE 13. WORKPLACE KNOW-HOW WHAT WORK REQUIRES OF SCHOOLS

COMPETENCIES FOUNDATION

TEACHING, ASSESSING AND LEARNING IN CONTEXT



In order for the legislation to promote its own intent, it will need to spell out - in no uncertain terms - and mandate industry standards into the design of the programs. Only with direct industry involvement, will the schools be able to develop and deliver effective computer literacy programs.

Computer literacy identified.

In order to provide continuity to a computer literacy program, it is essential that the state identify and define what constitutes student computer literacy. Consequences of the information-age revolution are the increasing needs to make continuing adaptations to rapidly changing technology, thereby making it difficult to define computer literacy in terms of specific applications. Instead, it will be necessary to identify sets of general skills that will provide the learner with a basic knowledge of technology, the ability to transfer the knowledge to specific tasks and, more importantly, keep pace with technology as it evolves. Therefore, a widely accepted working definition of computer literacy will need to be flexible, in order to accommodate interpretation, yet specific enough to identify skills and provide direction.

Following is a definition of computer literacy that is adapted from the model presented by Schwartz (1989). This model has identified the generic competencies and outcomes necessary to prepare students for general workplace computer literacy, and was the basis for the competencies included in the survey (see Appendix B).

For students to be computer literate, they should be able to demonstrate an understanding of each of the following:

1. Encoding-decoding or the method of representing information.
2. Recording-entering or the translation of information into various codes.
3. Storage or the capacity for information retention.
4. Processing or the deliberate systematic manipulation of information for specific purposes.
5. Retrieval-display or the ability to move information from its origination point to the point needed.
6. An awareness of the technology's impact on society.

Performance objectives should include each of the following abilities:

1. Encode, store and retrieve information.
2. Access stored information (data banks, internet, library systems, etc.).
3. Learn and utilize various software applications (vocational, educational, entertainment, etc.).
4. Define technology's emerging impact on society.
5. Demonstrate higher level problem solving (flow charts, trouble-shooting, etc.).

By following this model, schools should be able to design programs that use learning contexts, tasks, materials, and procedures that mirror as closely as possible subsequent work tasks and situations. Students need to be clear about what they are to learn and why, and how the knowledge and skills they are acquiring will be applied to the workplace.

Instructor certification requirements.

For computer literacy instruction to be effective, it will be necessary for teachers to be computer literate. To accomplish this, it will be necessary for the California State Department of Education to research and develop a program for instructor computer

literacy certification. Certification should include all the same competencies identified above, along with the ability to integrate technology into all subject areas and utilize technology as a tool - similar to how it is used in the workplace. This will require instructors to understand contextualized learning, teaching generic skills, workplace modeling, and transfer of learning. In order to fully integrate technology into all curriculum areas, it will be necessary to certify all high school instructors in all subject areas. This certification could be phased in yearly until all instructors are computer literacy certified. Because of the dynamic nature of technology, re-certification should be required every two or three years.

For a high school computer literacy program to be effective, it is important that instructors have a solid understanding of technology, and it's role in the workplace and society. According to Raizen (1989), in the technologically advanced environments of today, the better educated face a future of expanding opportunities and rising wages; the poorly educated face a future of declining opportunities and poverty.

Summary

In order to prepare students with the computer literacy skills needed to be competitive in the workplace, it is paramount that high schools identify the necessary competencies and outcome objectives, seek input from business and industry regarding needed skills, and prepare instructors to develop and deliver effective computer literacy programs.

APPENDIX A

Telephone Introduction

Hello, Mr./s._____,

My name is Tracy Borchers. I'm a candidate and conducting related research for a master's degree with emphasis in Voc Ed at California State University, San Bernardino. I am conducting five minute interviews with principals at Southern California high schools to gather some information on how high schools are implementing computer literacy programs. Do you mind if I ask you a few questions?

APPENDIX B

Survey Questionnaire

DEMOGRAPHICS

Name_____ Title_____

School_____ District_____

Years in Principal's Position ___1-3 ___4-8 ___9-12 ___13+

Years of teaching experience ___1-3 ___4-8 ___9-12 ___13+

What is the highest level of education you have completed?

___Bachelors ___Masters ___Doctoral

In what major? _____

Do you have a computer in your office for your use?

___Y ___N

Is it ___IBM/Clone ___Apple ___Macintosh

How many hours per week do you use it?

___0-1 ___1-3 ___4-7 ___8-10 ___10+

Do you have a computer in your home for your use? ___Y ___N

Is it ___IBM/Clone ___Apple ___Macintosh

How many hours per week do you use it?

___0-1 ___1-3 ___4-7 ___8-10 ___10+

What is your level of computer proficiency?

___ Level 0 - No knowledge
___ Level 1 - demonstrate use of basic software packages
___ Level 2 - demonstrate use of operating system to manipulate files and trouble shoot
___ Level 3 - demonstrate proficiency in programming, manipulating and customizing the operating system

Which of the following best describes your age?

___25-29 ___30-37 ___38-45 ___46-52 ___53+

DISTRICT DATA

1. Does your district have a written technology plan for student computer literacy?

___Y ___N ___Don't know, go to #2

A. Which of the following is included in the District plan?

___ Promotes a basic understanding of how a computer works (e.g., encodes, stores and retrieves information).
___ Provides basic skills for interacting with a computer to access stored information (e.g., library skills).
___ Familiarize students with various applications of available software (e.g., vocational, educational, entertainment and etc.).
___ Provide basic skills for using computers to run available software.
___ Develop awareness of the computer's impact on society (e.g., technological advancement).
___ Develop programming skills.
___ Don't know

B. What student performance objectives has the District identified?

___ Encode, store and retrieve information
___ Access stored information
___ Learn and utilize various software applications
___ Define technology's emerging impact on society
___ Demonstrate higher level problem solving
___ Don't know

C. Does the plan specify a computer hardware preference?

___Y ___N go to #2

If yes, is it ___IBM/Clone ___Apple ___Macintosh

C1. What criteria was considered to select the hardware?

___ Cost
___ Personal Experience
___ User Friendliness
___ Available Support
___ Curriculum Objectives
___ Compatibility
___ Industry Standards
___ Staff Expertise

C2. What sources of input were used by the District to help with the hardware selection process?

___ Parent Group
___ Staff recommendation
___ District Consultant
___ Private Consultant
___ Advisory Group
___ Don't know

SCHOOL DATA

2. Does your individual school have a written technology plan for student computer literacy? ___Y ___N go to #3 ___Don't know, go to #3

A. Which of the following is included in the District plan?

___ Promotes a basic understanding of how a computer works (e.g., encodes, stores and retrieves information).
___ Provides basic skills for interacting with a computer to access stored information (e.g., library skills).
___ Familiarize students with various applications of available software (e.g., vocational, educational, entertainment and etc.).
___ Provide basic skills for using computers to run available software.
___ Develop awareness of the computer's impact on society (e.g., technological advancement).
___ Develop programming skills.
___ Don't know

B. What student performance objectives has the District identified?

___ Encode, store and retrieve information
___ Access stored information
___ Learn and utilize various software applications
___ Define technology's emerging impact on society
___ Demonstrate higher level problem solving
___ Don't know

C. What is the length of your review cycle for the plan?

___ <1 Year ___ 3 Years ___ 5 Years ___Don't know

D. What evidence do you have that the outcome objectives for the student computer literacy plan are being met?

___ Standard test
___ Follow up data from Employers
___ Portfolio evaluation
___ Staff assessment

E. Do you specify a computer hardware preference in the plan?

___Y ___N go to #3 ___Don't know, go to #3

1. If yes, is it ___IBM/Clone ___Apple ___Macintosh

2. What criteria was considered to select the hardware?

___ Cost
___ Personal Experience
___ User Friendliness
___ Available Support
___ Curriculum Objectives
___ Compatibility
___ Industry Standards
___ Staff Expertise
___ District Mandate

3. What sources of input were used to help with the computer hardware selection process?

___ Parent Group
___ Staff recommendation
___ District Consultant
___ Private Consultant
___ Advisory Group
___ Don't know

OTHER DATA

3. When was your last computer hardware purchase?

___ <3 mos ___ 3-6 mos ___ 6-12 mos ___ >12 mos

A. Did you purchase ___ IBM/Clone ___ Apple ___ Macintosh

B. What criteria was considered to select the hardware?

___ Cost
___ Personal Experience
___ User Friendliness
___ Available Support
___ Curriculum Objectives
___ Compatibility
___ Industry Standards
___ Staff Expertise
___ District Mandate

C. What sources of input were used to help with the computer hardware selection process?

___ Parent Group
___ Staff recommendation
___ District Consultant
___ Private Consultant
___ Advisory Group
___ Don't know

4. What computer platform is currently used by the majority of corporations in your area? ___ IBM/Clone ___ Apple ___Macintosh ___ Don't know

5. What computer platform is most represented currently in your school?

___ IBM/Clone ___ Apple ___ Macintosh ___ Don't know

References

Berryman, S., & Bailey, T. The Double Helix of Education & the Economy. The Institute on Education and the Economy. Teachers College Box 174, Columbia University, New York, New York, 1992.

Biermann, A. W. (1994, February). Computer Science for the Many. Computer, 62-73.

Bloom, B. S., Madaus, G. F., Hastings, J. T. Evaluation to Improve Learning. New York: McGraw Hill, 1981.

Dutton, W. H., & Anderson, R. E. (1989, Spring). Computers and Literacy: Differing Perspectives in the Social Sciences. Social Science Computer Review, 7(1), 1-6.

Garrett, N. A., & Lundgren, T. G. (1992, April). The Need for programming Skills. Business Education Forum, 11-13.

Goals 2000: Educate America Act Fact Sheet. (1994). California Department of Education. 721 Capitol Mall: P.O. Box 944272, Sacramento, CA 94244-2720.

Hannum, W. (1992, January). Reconsidering Computer Literacy: Is It a Basic Skill?. The Education Digest, 57(5), 8-11.

Hannum, W. (1991, February/March). Reconsidering Computer Literacy: A Critique of Current Efforts. The High School Journal, 152-158.

Kondracke, M. (1992, September). The Official Word. Macworld, 9(9), 232-236.

Lewis, M. (1992). Emerging Uses of Computers for Education: An Overview of Tools and Issues for Vocational Educators. Berkeley, CA: University of California, Berkeley, National Center for Research in Vocational Education.

Osborne, C. (1993). Planning for IT Literacy in an Institution of Higher Education: A Case Study. The Computer Journal, 36(4), 343-350.

Policy Statements 53 & 54. (1993, October). This We Believe About the Role of Business Education in Technology. Business Education Forum, 11-14.

Raizen, S. (1989). Reforming Education for Work: A Cognitive Science Perspective. Berkeley, CA: University of California, Berkeley, National Center for Research in Vocational Education.

Rosenberg, R. (1991, January). Debunking Computer Literacy. Technology Review, 59-65.

Schwartz, J. (1989). Implementing Computer Literacy in Our Schools: What Have We Learned. Computers in the Schools, 6, 159-166.

School To Work Opportunities Act. (1994). U.S. Department of Labor, 220 Constitution Ave., N.W., Room C-2318, Washington, DC 20210

Secretary's Commission on Achieving Necessary Skills. (1991). U.S. Department of Labor, 220 Constitution Ave., N.W., Room C-2318, Washington, DC 20210.

Stasz, C., McArthur, D., Lewis, M., & Ramsey, K. (1990). Teaching and Learning Generic Skills for the Workplace. Berkeley, CA: University of California, Berkeley, National Center for Research in Vocational Education.

Thomas, R., Anderson, L., Getahun, L., & Cooke, B. (1992). Teaching for Transfer of Learning. Berkeley, CA: University of California, Berkeley, National Center for Research in Vocational Education.

Thomas, R., Johnson, S., & Anderson, L. (1992). Alternative Perspectives of Instruction and Cognitive Theory: Implications and Proposals. Berkeley, CA: University of California, Berkeley, National Center for Research in Vocational Education.

Troll, D. A., (1989, February). Computer Literacy as Ideology: Whose Side Are You On?. Collegiate Microcomputer, 7(1), 52-60.

Wiggs, L. H. (1992, April). Providing Skills For an Information Society. Business Education Forum, 19-21.