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THE PERCEIVED EFFECTS OF LOS ANGELES UNIFIED SCHOOL

DISTRICT - MATHEMATICS, SCIENCE, AND TECHNOLOGY CENTERS

(LAUSD - MSTC) ON

K-6 TEACHERS'/STUDENTS'

SCIENCE/TECHNOLOGY/COMPUTER LEARNING

by

Steven Paul Dierking

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A Dissertation Presented to the

FACULTY OF THE SCHOOL OF EDUCATION

UNIVERSITY OF SOUTHERN CALIFORNIA

In Partial Fulfillment of the

Requirements for the Degree

DOCTOR OF EDUCATION

December 1998

UMI Number: 9931840

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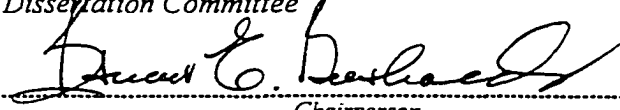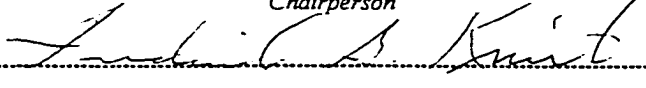
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*under the direction of h̲i̲s̲ Dissertation Committee, and
approved by all members of the Committee, has been
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of Education in partial fulfillment of the requirements for
the degree of*

DOCTOR OF EDUCATION

10/21/98
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DEDICATION

This dissertation is dedicated to my supportive family. My parents, Loren and Margot, set a wonderful example of how to set and accomplish goals. They were also there for my much-needed psychological support while "running my personal marathon" of writing the dissertation. My brothers, Dave, Jim, and Andy, were my "bouncing board" when I contemplated discontinuing the program. They also were there for my recreational releases. My whole family is very caring and success oriented. I love them all very much.

ACKNOWLEDGMENTS

I would like to express my appreciation to all of the Educational Leadership Faculty at the University of Southern California. Especially, I would like to thank my dissertation committee for their support during the writing of my dissertation. The committee consisted of the following professors: Dr. Stuart Gothold (Chairperson), Dr. Fred Knirk, and Dr. William Michael. A special thanks is extended to Dr. Gothold for keeping me focused on completing my dissertation. His guidance and advice regarding my dissertation were greatly appreciated.

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ABSTRACT

The Problem--General research has been inconclusive regarding the role that computers play in effective educational programs. Also, because of a lack of research information, it is currently difficult to assess whether California Technology Teacher Training Centers (CTTTCs) are perceived as effectively training teachers to teach their students the information learned in the CTTTCs. It is also unclear whether the training centers have set objectives to measure their success accurately. In essence, the training centers are currently unaware if what they are teaching the teachers during the training sessions is actually being used in the classroom, and is being taught to the children. Therefore, it is unclear whether the training centers are accomplishing their goals.

Methodology--Two California Technology Teacher Training Center (CTTTC) program teachers from five different CTTTCs completed questionnaires. When necessary, the CTTTC-program teachers were asked to answer follow-up interview questions after they had completed their questionnaires. Six CTTTC-trained teachers from five different CTTTCs completed one portion of their questionnaires directly after finishing their CTTTC classes. Another portion of their questionnaire was completed after they had taught their K-6 students about the information that they had learned at the CTTTCs. When necessary, follow-up interview questions were discussed with the teachers after they had completed the

second portion of their questionnaires. Two students from each of the thirty K-6 CTTTC-trained teachers' classrooms completed a questionnaire directly after the concepts had been taught to them by their CTTTC-trained teachers. When necessary, follow-up interview questions were discussed with the students after they had completed their questionnaires.

Conclusions--Ninety percent of the K-6 teachers stated that they would be able to incorporate what they had learned in class into their lesson plans. Even after teaching their K-6 students about the CTTTC information, 83% of the teachers indicated that the CTTTCs had adequately prepared them to train their students effectively in the subject matter. As the teachers were able to incorporate the information learned in their training classes into their lesson plans, it became evident that the CTTTCs had adequately prepared the teachers to instruct their students on the subject. The study also revealed that 63% of the K-6 teachers trained in the CTTTCs had technology support problems. Both the CTTTC instructors and the CTTTC-trained teachers agreed that access to computers and the Internet would definitely assist the teachers in learning the information taught in the CTTTCs. More importantly, access to computers and the Internet would be a valuable tool for the K-6 teachers to help teach their K-6 students the CTTTC-related information.

CHAPTER 1

THE PROBLEM

Introduction

All across the United States computer technology has been credited with

many noteworthy accomplishments during the 1980s and 1990s. Some of these

accomplishments are improving student attitudes toward learning, motivating

students, aiding instruction for special needs students, motivating teachers, and

assisting teachers in completing routine instructional tasks. Technology allows

them to utilize their time in more useful ways (*Report on the Effectiveness of*

Technology in Schools, '95-'96, 1996).

Computers are currently being used for a variety of different functions in

educational settings. According to Wilkinson (1996), computers may be used for

activities such as e-mail, chat sessions, interactive games and simulations, group

projects, and research, which help schools overcome impediments to quality

education for all.

Schools and teachers need to educate their students effectively. To ensure

the most effective education possible, computers are quite often needed to assist

the teachers. Unfortunately, even if schools have computers, many teachers are

unprepared to incorporate computers into their instruction and many may not even

know how to operate the computers (Piotrowski, 1992; Stecher & Solorzano,

1987). In fact, according to Barker (1994), two-thirds of all K-12 teachers have

had less than 10 hours of computer training. Technology, however, is constantly changing. In order for instructors to be effective teachers, they need continuous training regarding use of computers (Becker, 1992; Ehley, 1992; Jordan, 1993; Turkel & Chapline, 1984).

Increased use of computers in California schools requires more teacher training. California Technology Teacher Training Centers (CTTTCs) are places of learning where K-12 teachers are trained in the area of science, technology and computers (science/technology/computers) so that they may effectively instruct their students in the classroom. The CTTTCs also provide teachers with the opportunity to borrow equipment, materials, and supplies from an extensive loan collection. The professional library includes hundreds of books on science/technology/computers. The science/technology/computer equipment available for borrowing includes: projection microscopes, heart models, sets of hand lenses, computer-based laboratories with external probes, DNA finger printing kits, graphic calculators, and laser disk players. This equipment supports instruction in all areas of science/technology/computers (C. Holle, LAUSD, LA Systemic Initiative Science Coordinator, personal communication, August 26, 1997).

There are numerous issues regarding science/technology/computer teacher training which were explored throughout this study. The most pressing issues regarding science/technology/computer teacher training are the following: (a) the

CTTTCs' efficiency in training teachers in the areas of science/technology/ computers, (b) degree to which students taught by CTTTC-trained teachers absorb the information, and (c) the adequacy of classroom equipment necessary for teachers to instruct students in the use of science/technology/computers.

The instructional practices of teachers probably need to be changed to allow computer technology an opportunity to impact the educational process. According to Podenski (1981), "the instructional impact of computer technology is limited, because most teachers lack the ability and the commitment necessary to alter their instructional techniques to accommodate the computer" (p. 31). Attempts to increase the ability of teachers to incorporate technology into their teaching practices are being addressed by administrators and legislatures today.

Even though there are computers in virtually every public school throughout the United States, only half of the teachers reported that they had ever used the computers, and even fewer considered themselves regular users of the computers (Wiske, Zodhiates, Wilson, Gordon, Harvey, Krensky, Lord, Watt, & Williams, 1988). The lack of computer use by teachers has been partially attributed to a lack of equipment (Becker, 1990). Becker (1990) performed a survey which showed that many of the individuals who had completed questionnaires during the survey expressed an urgency for acquiring more computers. Similarly, Sheingold and Hadley (1990) reported that the teachers they had surveyed cited inadequate

amounts of hardware as a barrier to instruction. These observations came from instructors who were experienced and proficient at integrating computers into their teaching.

According to Chmielewski (1997), when key areas, such as technology available in public schools and the use of computers as part of the curriculum, are reviewed, California still lags noticeably behind the rest of the nation. This lag of technology availability in public schools is evidenced in Table 1.

Table 1

<u>**Information Pertinent to Technology in Schools**</u>

<u>Technology</u>	<u>California</u>	<u>United States</u>
Students per multimedia computer	N = 27	N = 21
Schools with video disk players	62%	55%
Schools with cable TV	64%	74%
Schools with satellite access	16%	28%
Students per CD-ROM	N = 27	N = 21
Schools with Internet access	65%	70%

Even though there has been minimal research to support the concept that classroom technology significantly improves learning, last year the nation's 105,000 K-12 schools bought $4.25 billion worth of computer hardware and software. Furthermore, according to IDC/Link, a market research company, that amount is expected to reach $9 billion per year by the end of the decade (Helm, 1997).

Tillman (1995) stated that there was a computer program in virtually every elementary school in the United States. Therefore, in one way or another, elementary school students in the United States are being exposed to computers. There have been large amounts of money devoted to implementing computers in primary schools. Yet, there has been minimal evidence of the extent to which this investment has improved student learning (Becker, 1992).

Kozma (1991) stated that because of how certain media attributes may interact with learner and task characteristics, the medium of delivery may be expected to affect the cognitive processes. Kozma continued by stating that a learner's prior knowledge will determine the strategy exercised in approaching a learning task (Hannafin & Savenye, 1993).

Computers are used for a variety of functions in educational settings. Some of these functions pertain to literacy (learning to read), information retrieval (which could make learning interesting and easy), and business/education activities (word-processing, spreadsheets, databases--developing reports and preparing students for future employment using these skills). Employees in today's work force must

know applications such as word-processing, and use of databases, spreadsheets, and electronic mail. It is paramount that students learn these applications in school in order to be prepared to enter the work force (Piotrowski, 1992).

According to Banks and Renwick (1997), even though Los Angeles spent more than $8.5 million on technology in the 1995-96 school year, many of its campuses still possess antiquated equipment. In 1997, schools were expected to spend $4 billion on computer technology across the country; but that is just a small portion of what it will cost for adequate availability of computers, Internet access, and teacher training for the schools (Banks & Renwick, 1997).

Information Regarding the CTTTCs

Originally the CTTTCs only serviced K-9 teachers, but because of increased funding provided by the following sources, the training and availability of materials and supplies were expanded to include K-12 teachers: National Science Foundation (NSF) Grant, Eisenhower Entitlement Grant, block grants, district general funds, bilingual funds, Chapter 1 funds, school improvement funds, and private donations (R. Archerd, personal communication, April 29, 1997; C. Holle, personal communication, May 2, 1997; D. Smedley, personal communication, April 28, 1997).

Where the Los Angeles Unified School District

CTTTCs Are Located

The Los Angeles Unified School District (LAUSD) CTTTCs are based at the following locations (C. Holle, personal communication, August 27, 1997):

- Balboa Technology Teacher Training Center

  located at 6625 Balboa Blvd., Van Nuys, California 91406.

- Monlux Technology Teacher Training Center

  located at 6155 Bellaire Avenue, North Hollywood, California 91606.

- Westside Technology Teacher Training Center

  located at 1630 Walgrove Avenue, Los Angeles, California 90066.

- East Los Angeles Technology Teacher Training Center

  located at 961 Euclid Avenue, Los Angeles, California 90023.

- San Pedro Technology Teacher Training Center

  located at 2201 Barrywood Avenue, San Pedro, California 90731.

Unique Nature of the CTTTCs

The CTTTCs are unique because they provide teachers with the opportunity to borrow equipment, materials, and supplies from an extensive loan collection. This option has not been provided at other training centers. The professional library includes hundreds of books on science/technology/computers. The science/technology/computer equipment available for borrowing includes projection

microscopes, heart models, sets of hand lenses, computer-based laboratories with external probes, DNA finger printing kits, graphic calculators, and laser disk players. This equipment supports instruction in all areas of science/technology/computers. Other training centers do not currently have access to such sophisticated equipment (C. Holle, personal communication, August 26, 1997).

The CTTTCs also provide teachers with an opportunity to borrow Full Option Science System (FOSS) Kits, Science and Technology for Children (STC) Kits, Insights Kits, and Issues Evidence and You (IEY) Kits (C. Holle, personal communication, August 28, 1997).

Geographical Range of the LAUSD CTTTCs

The five LAUSD CTTTCs service 420 elementary schools, 80 middle schools, and 50 high schools in the Los Angeles area. Each of the five LAUSD CTTTCs provides service for an equal number of schools in the LAUSD (approximately 20% each). In 1996, the five training centers in Los Angeles serviced over 11,000 teachers (C. Holle, personal communication, August 28, 1997).

Statement of the Problem Situation

General research has been inconclusive regarding the role that computers play in effective educational programs. Also, because of lack of research information, it is currently difficult to assess whether CTTTCs are perceived as effectively training teachers to instruct their students about science/technology/computers. It is also unclear whether the training centers have set objectives to measure their success accurately. In essence, the training centers are currently unaware if what they are teaching to the classroom instructors during the science/technology/computer training sessions is actually being used in the classroom, and is being taught to the children. Therefore, it is unclear whether the training centers are accomplishing their goals.

Purpose of the Study

Only minimal data was available regarding the effectiveness of CTTTCs. The results of this study provide a means to determine whether CTTTCs are effectively training California teachers, whether the teachers are learning and using the information acquired in the CTTTC classes to train their students in the classroom, and whether the students are better able to learn information taught by CTTTC-trained teachers. The findings of this study may indicate whether funding problems have had a perceived influence on the effectiveness of the CTTTCs.

The purpose of this study was to determine whether the current CTTTCs were effectively training California's K-6 teachers in the areas necessary to teach science/technology/computers to their students as perceived by the CTTTC instructors, the K-6 CTTTC-trained teachers, and the K-6 students themselves.

Questions To Be Answered

This study was undertaken to answer the following research questions regarding CTTTCs:

1. How effective have the CTTTCs been in training K-6 teachers, as perceived by the CTTTC instructors?

2. Have the goals and objectives of the CTTTCs been met, as perceived by the CTTTC instructors?

3. How effective have the CTTTC-trained K-6 teachers been in teaching their K-6 students the information learned in the CTTTCs, as perceived by both the K-6 teachers and the K-6 students themselves?

4. Have the goals and objectives of the CTTTC-trained K-6 teachers been met, as perceived by both the K-6 teachers and the K-6 students themselves?

Significance of the Study

The results of this study may be of value to school board administrators, CTTTC coordinators, teachers, parents, and the students themselves. The results

may help to determine the success rate of the CTTTCs, of the teachers who were trained by the CTTTCs, and of the students who were trained by the CTTTC-trained teachers. This study may also help to determine whether funding problems were an issue regarding the training of both the K-6 teachers and their students.

Delimitations

The following delimitations were present in this study:

1. The number of CTTTCs involved, the number of CTTTC personnel surveyed, the number of CTTTC-trained teachers surveyed, and the number of students surveyed who were taught by the CTTTC-trained teachers were limited to a manageable number.

2. The inquiries listed on the questionnaires have been restricted to only those topics listed on the questionnaires. Perhaps additional science/technology/computer questions should have been asked to help gather the data for this study.

3. The study was limited to the topics taught in each CTTTC. It did not explore all science/technology/computer topics.

Limitations

The following limitations were evident in this study:

1. The questionnaires only reflected the opinions of those involved in the study.

2. A pilot study was performed to help clarify the questionnaires involved in this study. Even though a pilot study was performed, there were still limitations inherent within the questionnaires.

3. The subjects used in this study were volunteers. Therefore, because the subjects were not selected on a random basis, only certain types of subjects might have been represented in this study. Volunteers tend to be outspoken individuals; therefore, this study might have only involved subjects who were outspoken.

Definitions of Terms

The following definitions were applicable for this study. Some of the definitions were developed with the help of Durborow (1996) and Stein (1978):

CD-ROM: Compact Disk - Read Only Memory. A method for mass storage of data and information.

Computer: An electronic machine capable of accepting and processing data and producing results by carrying out repetitious and complex mathematical operations at high speeds.

Computer Network: Computers that have been connected as a group, so that they can communicate with each other.

CTTTCs: California Technology Teacher Training Centers are places of learning where K-12 teachers are trained in the areas of science/technology/computers so that they may effectively instruct their students in the classroom. CTTTCs also provide teachers with the opportunity to borrow equipment, materials, and supplies from an extensive loan collection. The professional library includes hundreds of books on science/technology/computers. The science/technology/computer equipment available for borrowing includes projection microscopes, heart models, sets of hand lenses, computer-based laboratories with external probes, DNA finger printing kits, graphic calculators, and laser disk players. This equipment supports instruction in all areas of science/technology/computers.

CTTTC-Program Teachers: CTTTC class leaders who train K-12 teachers in the area of science/technology/computers so that they may effectively teach their students about science/technology/computers in the classroom. The K-12 training class teachers must be specialists in the subject areas being taught. In Los Angeles County, there are more than 500 K-12 training teachers who have proven themselves proficient in certain subject areas.

CTTTC-Trained Teachers: K-12 teachers who are trained at the CTTTCs in the area of science/technology/computers so that they may effectively teach their students about science/technology/computers in the classroom. A K-12 teacher must complete at least one CTTTC-training class to be considered a CTTTC-trained teacher.

E-mail: Electronic Mail. An Internet tool that allows the user to send a message to another user or to a whole group of people all over the world.

Internet: A network of thousands of different networks. It is the world's largest group of connected computers. The Internet allows the user to access information from millions of computer files containing photographs, documents, and video and sound clips.

Laser Disk: Another term for CD-ROM.

LAUSD - MSTC: Los Angeles Unified School District - Mathematics, Science, and Technology Centers (LAUSD - MSTC) involved in this study. The teacher technology training centers used in this study are all affiliated with the Los Angeles Unified School District (LAUSD). Throughout this study the Los Angeles Unified School District Mathematics, Science, and Technology Centers (LAUSD - MSTC) will be referenced as California Technology Teacher Training Centers (CTTTCs).

Multimedia: Various means of communication. Usually implies that visual and

audio applications are used in conjunction with one another.

Students Trained by the CTTTC-Trained Teachers: K-12 students who are

taught in the classroom about science/technology/computers by their

CTTTC-trained teachers.

World Wide Web: An international hypertext system that allows the user to move

between documents on the Net.

Organization of the Remainder of the Study

Chapter 2 reviews the literature which pertains to this study. Chapter 3

discusses the methodology and procedures used to collect and to analyze the data.

It focuses mainly on the procedures and instrumentation used in this study. Chapter

4 presents the findings from the data collected. Conclusions of the study,

recommendations, and implications for further study are all presented in Chapter 5.

CHAPTER 2

REVIEW OF THE LITERATURE

Overview

The purpose of this chapter is to discuss the past, present, and future events related to technology in the K-6 classroom. The following topics are discussed in this chapter:

1. Status of technology in schools (United States and California).

2. Emerging technologies in education (CD-ROM, multimedia, etc.).

3. Technology/computer use in schools (the Internet, literacy, information retrieval, word-processing, etc.).

4. Staff development programs for computer technology.

5. Status of technology/computer programs in Los Angeles County and Orange County.

6. San Diego principal–proponent of technology.

7. Funding sources for Los Angeles Unified School District (LAUSD) Technology Training Centers.

8. Knowledge gaps about CTTTCs (statement of the problem situation).

Status of Technology in Schools (United States and California)

The United States substantially increased the use of computer-based technology for instructional purposes during the decades of the 1980s and 1990s

(Report on the Effectiveness of Technology in Schools, '95-'96, 1996). In 1981,

only 18% of American schools had one or more computers in their classrooms;

whereas in 1987, 95% of American schools had access to one or more computers in

their classrooms (U.S. Congress, Office of Technology Assessment, 1988). During

December of 1994, it was estimated that 6.2 million computers were installed in K-

12 classrooms across the United States (*SPA Market Study Report,* 1995).

All across the United States computer technology has been credited with

many noteworthy accomplishments during the 1980s and 1990s. Some of these

accomplishments are improving student attitudes toward learning, motivating

students, aiding instruction for special needs students, motivating teachers, and

aiding teachers in completing routine instructional tasks. Technology allows them

to utilize their time in more useful ways (*Report on the Effectiveness of Technology*

in Schools, '95-'96, 1996).

According to Cradler (1996), President Clinton, during his State of the

Union Speech in January 1996, emphasized the need for every student to be

technically literate for the 21st Century. Clinton's four goals were the following:

- Provide all teachers and students with access to modern computers.

- Connect the Information Superhighway to every school in the United States
  of America.

- Develop software to benefit all subject areas.

- Provide teachers with the necessary training so that they may help students become proficient with technology.

In order to accomplish the four goals listed above, President Clinton must ensure that the following actions are taken:

- Wire all of the nation's classrooms for computer access to the Internet by the year 2000.

- Create a private/public technology "matching fund" program which will be used to provide every student with access to a cutting-edge computer and every teacher with the skills and software to make the best possible use of available technology.

- Challenge educational software and entertainment leaders to produce better educational software to make learning more exciting and interesting for the students (Cradler, 1996).

Clinton reiterated his interest of integrating technology in schools during his State of the Union Speech in February 1997. In his speech, Clinton stated that he would increase spending for elementary and secondary education to renovate schools for computer and Internet hookups. Clinton continued by stating that he was challenging the United States of America to connect every classroom and library to the Internet by the year 2000 (Apple Jr., 1997; Hickox, 1997).

According to Hickox (1997), a study performed by the *Orange County Register* showed that approximately 45% of Orange County's public schools had at

least one classroom or office linked to the Internet in 1995. This percentage has most likely increased because, since that time, the state has allocated $100 million for new technology programs. State Superintendent Delaine Eastin called for a school-bond initiative to help pay for more than $1 billion in construction costs associated with updating the wiring in older schools to accommodate computers.

The State of California has been noticeably behind the rest of the country regarding the average number of students assigned per computer in California schools. According to Benson (1996), the State of California averages 13.9 students per computer; whereas the national average is 10 students per computer. California must attempt to improve its ratio of students per computer if it wants to compete with the other 49 states regarding the preparation of students for the future through educational technology.

According to Lazarus and Bryson (1997), Governor Pete Wilson stated that the following steps must be taken to allow California schools the opportunity of catching-up to the rest of the country regarding the level of technology taught to students in the classroom and improvement in the student to computer ratio in California schools:

- California must commit the necessary funds and staffing to finance state-of-the-art computers in every classroom. Computers must be connected to the Internet and both teachers and parents must be trained to use the computers

efficiently and effectively so that they are better able to teach regarding technology and the Internet.

- Computer literacy should be made a basic competency that all students are expected to exhibit when tested for at regular intervals. The concept of literacy being made a competency was developed, and is now being used, in the State of North Carolina.

- Libraries, community centers, Head Start centers, and other neighborhood gathering places should become technology centers that ensure affordable access to computers and telecommunications for everyone.

The measures listed above should be implemented in an organized, step-by-step fashion, that is both affordable and easy in their execution. The governor called for reaching his goals by the year 2001—a goal that seems like a logical and realistic timetable for implementing this comprehensive strategy. The identified funding sources should include both public and private support (Lazarus & Bryson, 1997).

According to Zehr (1998), California policymakers should seriously consider the following technology recommendations:

- Adopt standards for what students should know about technology and be able to use it.

- Require teachers to have technology training to obtain a teaching credential.

- Regularly update its technology plans and evaluate how well the plans are being implemented.

- Periodically monitor the presence and use of technology in schools, and fund technology as an ongoing commitment rather than as a one-time expense.

- Create opportunities for technology teacher training.

- Communicate information about effective/innovative uses of educational technology.

- Help schools update their technology infrastructure.

- Take steps to assure equitable technology distribution.

The State of California has recently attempted to increase the use of computer-based technology for instructional purposes. California legislators finally realized the need for funding to help equip schools with the tools to properly train children in the area of technology. For example, the AB 1302 (Murray) and the AB 1519 (Morrow) bills contain the legislative authorization for allocation of approximately $35 million to California schools for educational technology (Cradler, 1996). This money would aid California schools immensely in their quest for educational technology.

Emerging Technologies in Education

Computers have been used for instructional purposes for the last three decades. During that time, advances in computer technology have far exceeded the expectations of even the experts. According to Alessi and Trollip (1991), educational computing first started with a few large government-funded projects which used mainframes and minicomputers. In the early 1960s, the University of Illinois was instrumental in the pioneering effort of using computers for instructional purposes. The project at the University of Illinois enabled computer-based-instruction to integrate text and graphics, and also to provide instructors with one of the first programming environments for computer-based instruction. With that information in mind, a new concept of learner-controlled instruction was developed (Wydra, 1980).

A number of research efforts have been explored regarding technology information. One area that researchers have recognized as needing to be addressed was the amount of computer equipment which was available for instructional purposes. Data to answer this question were provided by large-scale national surveys (Center for the Study of Schools, 1983; U. S. Department of Education, 1982). These two studies illustrated that by the mid-1980s there were sufficient numbers of computers in elementary schools to have a major impact on the instruction in the schools.

Some of the trends in instructional programs have been the use of CD-ROMs and the use of foreign language technology resources. According to Bakker and Lathrop (1996), CD-ROM is fast becoming the technology of choice. Of the 132 computer software and CD-ROM programs recommended by the California Software Clearinghouse in 1995, over half have been available on CD-ROM, with 50 of them published exclusively on CD-ROM (Bakker & Lathrop, 1996). At the time of this writing, there were 63 programs available only on computer disk, and 19 available on either CD-ROM or computer disk.

Foreign language technology resources are also on the rise. According to Bakker and Lathrop (1996), more than one-fourth of the recommended programs mentioned previously (36 out of 132), have a Spanish soundtrack or a separate Spanish version. Many of the programs also have classroom support materials written in Spanish, and a few are also written in French and German (Bakker & Lathrop, 1996). Teaching English to foreign students while using their native language eases the transition.

CD-ROM technology is leading the way for schools in the next decade. According to Lynch (1996), a company called Digital Networks has developed a system which includes VCRs, CD-interactive players, and computers wired to each other and to the Internet. The system, which has already been installed at several Southern California schools, allows teachers the capability of emitting pictures and movies at the flick of a switch. For example, if a Spanish teacher says "paragua,"

he or she can instantly bring up a video image of an umbrella on the screen so that all of the students know what the word means. If a student asks a question about Barcelona, the teacher can bring up a still picture of Barcelona from a CD-interactive, sequence into a video of "El Cid," and then tune in to a Mexican radio station, all with his/her remote control.

The Digital Networks system costs about $700,000. As stated earlier, the system consists of a series of VCRs, CD-interactive players, and computers wired to each other and to the Internet. Rather than wasting an instructor's time making sure the correct tapes or disks are loaded for the various classes, every system is automated. Don Stone, the technology specialist for Digital Networks, stated that when cable providers eventually start to use such a service, the video and data will be stored on computer hard drives, and thus tapes and CD players will be eliminated (Lynch, 1996).

A study was performed at Ball State University regarding the concept of students learning from CD-ROMs. According to Carroll (1995), the study at Ball State University explored a concept concerning the effectiveness of students using CD-ROMs while learning how to read. The researchers discovered that children comprehended more information while using interactive computer software than they did by just reading a book containing the same subject matter. Over an eight-week period, a team studied two classes in their laboratories. One class read seven books and the other class read the same material on CD-ROM. The students using

the computers, in comparison with students not using the CD-ROM, consistently scored higher when tested on the longer, more difficult narratives. There was no difference, however, between the scores of students in the two classes regarding the less-complicated stories. Lawrence Smith, chairperson of the elementary education department, was quoted in the article as saying, as quoted in Carroll (1995), "With a CD-ROM, you can click on a word and the word can be pronounced, defined, or used in context. Children don't have to call on the teacher to pronounce the word. Kids don't have to raise their hands and admit that they don't know a word" (p. 1).

Science/Technology/Computer Use in Schools (K-6)

Computers are used for a variety of different functions in educational settings. According to Wilkinson (1996), computers may be used for activities such as e-mail, chat sessions, interactive games and simulations, group projects, and research, which help schools overcome impediments to quality education for all. Connectivity is benignly blind, often more forgiving than is an instructor, willing to repeat something until the learner masters it, and exhibiting nearly always availability. It also encourages branching out into related topics (Wilkinson, 1996).

According to Wilkinson (1996), a connected school has a great deal to offer students who speak little or no English. Even though English is the dominant language used in international connectivity, a non-English speaker can become just as proficient by navigating through the many non-English Internet/World Wide

Web resources. Connectivity could also help small and remote schools produce graduates who are ready to compete in technological job markets or in college studies.

The Internet is not only a new means to find and receive data, but also a way to publish and to distribute information. Never before have so many people had the opportunity to participate or exchange information on a worldwide network (Leiken, 1996).

The Internet/World Wide Web is a wonderful teaching tool for children. Unfortunately, the price of technology is high. According to Leiken (1996), the Internet is not "plug and play." Educators who want to get their classrooms on-line must consider the following costs:

- The external connection, which is the wide area network that connects schools to each other and to the Internet.

- The internal connection, which is the local area network that links computers within the given school.

- The computer, video, and related hardware (including the file servers, printers, scanners, and other equipment needed for full function).

- The computer software, which consists of an operating system and the necessary software to operate the World Wide Web/Internet.

- Teacher training (initial as well as technological advances).

- Ongoing operational support if the system crashes.

According to Winik (1997), a parent "seeing" computers in the school does not guarantee that the machines are being used well. Some questions to ask are the following:

- How much time do students spend using the computers, and how are they supervised? Who answers questions?

- Does the school have a technology plan? What are its priorities (buying more machines, connecting to the Internet)?

- Are computers used to help teach core subjects, such as mathematics or writing skills, or are they used for activities outside of the curriculum?

- How are the teachers trained?

- Who monitors or safeguards children on the Internet?

- What kinds of software are students using? Is it appropriate for different ages and skill levels?

According to a survey performed by *Instructor Magazine* (1991), the following three areas of results, from an undisclosed number of K-12 classroom instructors, were determined. Table 2 presents technology's teaching impact. Table 3 presents the types of software used in the classroom. Table 4 presents how the computer is being used in the classroom or laboratory.

Table 2

Technology's Teaching Impact

Statement	Percentage
Technology had improved the quality of their teaching	59%
Technology had improved their students' achievement	47%
Technology had played a part in the restructuring of their schools	60%
Their use of computers and other technology had raised their status as teachers	67%

Table 3

Types of Software Used in the Classroom

Software	Percentage
Drill and Practice	86%
Word-processing	84%
Tutorials	58%
Graphics	56%
Desktop publishing	49%
Classroom management	46%
Simulations	44%
Database	38%
Spreadsheet	28%
Programming	25%
Communications	18%

Table 4

How the Computer Is Being Used in the Classroom

or Laboratory

Usage	Percentage
Individual instruction	81%
Drill and practice	80%
A tool by students	68%
A tool by the teacher	67%
Programming	19%
Telecommunications	10%

According to Becker (1990), more and more teachers are starting to use the computer as an integral part of their lesson plan. Teachers prefer the ease of using a computer during their lectures versus struggling with papers and notes. Rather than providing a learning environment for motivating high-order thinking, problem solving, and deep understanding, the computer tends to reinforce other traditional instructional practices such as workbook drill and practice.

Mueller (1997) performed a survey involving 111 Kappans and 263 undergraduates in general education, reading methods, and science methods classes. The results of the survey showed a modest relationship between a positive attitude toward computer-assisted learning and age. The survey also showed that teachers with more experience were more positive about computer-assisted

learning. Elementary teachers and those preparing to be elementary teachers were not as positive about computer-assisted learning as middle school and high school teachers.

Winner (1983) explored the subject of training upper elementary teachers in computer literacy for classroom implementation. That study, which involved the computer integration efforts of one elementary school, indicated how there was little distinction between the training of teachers and training of computer professionals. It was first decided, after an informal needs assessment, that in order for teachers to be effective in the classroom, a specific training program was needed to help train the faculty regarding use of computers. Attendance at the training class was voluntary. The instruction, which lasted for one academic year, was taught by a fellow instructor. Evaluations regarding the training class were performed weekly. The goals of the program were to demonstrate an increase in faculty awareness of possible computer classroom interactions and to extend this awareness to demonstrated experimental classroom usage by the participants. The study indicated that the implementation of classroom computers is necessary to help induce changes in both the elementary curricula and classroom regularities. After realizing the necessity for computer software in the lesson plan, the school administrators and faculty members were incorporating new software into their instruction (Winner, 1983).

Staff Development Programs for Computer Technology

Kuerbis and Loucks-Horsley (1989) developed the following three

approaches to help teachers improve their applications of computers: (a) training,

with peer coaching; (b) peer dialogue; and (c) action research. According to Joyce

and Showers (1982, 1988), who studied training designs that help teachers adopt

new teaching behaviors, effective training presents the following ideas:

- The theory and rationale for the new teaching strategy.

- Demonstration of the strategy.

- Opportunities for the teachers to practice the strategy under controlled

  conditions.

- Practice by teachers of the strategy in the classroom with observation and

  feedback by a colleague (peer coaching).

Joyce and Showers (1982, 1988) found that peer coaching is critical to the success

of the training, but yet it is most frequently omitted from training sessions.

Another way to help teachers adopt new strategies is to engage them in

planned, thoughtful dialogue. Kuerbis and Loucks-Horsley (1989) found that the

goals should be to improve their planning before and after lessons by encouraging

teachers to reflect on their teaching practices, to enhance their thinking and decision

making during teaching, and to modify their beliefs, attitudes, and theories about

teaching.

Another model of staff development that Kuerbis and Loucks-Horsley identified was the teacher as researcher. According to Simmons (1985), teachers who engage in research (a) change their thinking skills, habits, or styles; (b) develop new theories of action in the classroom; and (c) modify their teaching practices. Furthermore, according to Lieberman (1987), action research can give teachers a sense of empowerment, can stimulate reflection about teaching, promote interaction among colleagues, and can increase teachers' interest in applying research findings.

According to Gibbons (1997), access to the ideas and information that improve teaching are provided through effective staff development programs. He continued by stating that, unfortunately, staff development is too often limited by a lack of time and funds. Without requiring long hours away from the classroom, the Educational Telecommunications Network (ETN) is an economical way to provide the educators with the latest in curriculum reform, research, and teaching methods.

ETN, sponsored by the Los Angeles County Office of Education, provides many useful educationally related functions. One of these functions includes acting as a satellite network that provides live staff development programs to school districts nationwide. Teachers and other colleagues model lessons and give telecast reports on their research regarding curriculum reform. The viewers may use a toll-free telephone number to participate actively in a question-and-answer session at scheduled intervals during each telecast (Gibbons, 1997).

In some instances where funding is not available for training teachers in technology, corporations are called upon to help. According to Hall (1996), at Washington Middle School in La Habra, California, a corporate-backed academy trains teachers who need as much help as, or more help than, the students. The companies consider it an investment in the skills of future high-technology labor. Some of the companies donating financial support are Toshiba, Hughes Electronics, and Metronics.

Similar to the companies just mentioned, Disneyland has donated CD-ROM software to 30 elementary schools in the Anaheim City and Magnolia school districts. The education-oriented software was designed by Disney Interactive for use by students in kindergarten through third grade. The software emphasizes the following skills: reading, vocabulary, problem solving, creative-thinking, and critical-thinking. Jill Bolton of Disneyland Educational Programs, as quoted by Gonzales (1997), stated that "these interactive CD-ROMs reinforce the kind of curriculum being taught in the early elementary grades, give students a positive experience with technology, and help them discover that learning is fun" (p. 3).

The Boeing Company annually contributes almost $5 million to K-12 programs. This sum is split among districts where the company has a major facility. In fact, education is the largest external contribution in Boeing's budget. Computers and surplus properties are also provided by Boeing resources. Boeing realizes that improvement in the school system needs to happen now. By donating

the money to the schools, Boeing has been essentially investing in its own future, as some of the students learning on their donated computers may eventually work for Boeing (Soloveichik, 1997).

Lee (1996) presented a list of key elements and benefits of exemplary technology staff development. They are the following concepts:

- Local staff members should nearly always be available for follow-up help, even when outside consultants are used for workshops.

- After teachers have completed their workshops, they should have easy access to the same hardware and software as that on which they were trained.

- Teachers should nearly always be the primary trainers of teachers.

- Teacher training should nearly always be directly tied to classroom and curriculum school-reform objectives.

- Staff development should be at least 25% of the technology budget.

- Learning to use technology is not voluntary, it is required.

- Administrators (e.g., principals, superintendents) should take the technology staff development courses along with their teachers.

- Time should be made available in the teachers' work schedules for technology staff development.

According to *Education Week* (1997), school technology has not been one of California's strong points; instead, it has been something of an embarrassment.

According to a survey performed by *Education Week* (1997), the following results

were determined from an undisclosed number of California eighth-grade students

reporting on the frequency of computer use for mathematics:

- Never/hardly ever   61%

- Once or twice a month   14%

- Once or twice a week   13%

- Almost every day   12%

According to Piotrowski (1992), software and hardware technology is

advancing very quickly. The software that is used for educational training by the

teachers and the software used by the students in the classroom becomes outdated

within six months after use. The same conclusion is applied for the hardware which

includes computers and all of the peripherals related to the computers. If the

teachers remain current on the various hardware and software technology, the

students will also keep their skills current and this will help them prepare for high

school, college, and/or their future vocations.

Barker (1994) discovered that a motivated and enthusiastic instructor is an

important element when teaching children about technology. Students can become

motivated through their instructor's energy, provided that the instructor emits the

energy required to motivate the students. Sometimes, the newness of the

technology-related subjects is enough to hold the student's attention, but more

often than not, it is the genuine enthusiasm of the subject itself that motivates the students to learn the technology information.

The Internet is becoming a very popular option when investigating staff development programs for computer technology. For example, information involving the Technology Teacher Leader Project (TTL), which is supported by the Los Angeles County Office of Education (LACOE), may be accessed using Internet address http://www.lacoe.edu/tfl/ttl.html. The Internet TTL offers information about the TTL Project Goal, TTL Project Implementation, District and TTL Commitments, TTL Training Outcomes, TTL Training Plan Implementation, and various other concerns (including with whom to communicate to become involved with the TTL project).

Other staff-development-computer-technology-program information may be accessed using the following Internet addresses:

http://library.usask.ca/hytelnet/oth/oth134.html.

http://www.beecher.will.K-12.il.us/pub/classtech.html.

http://www.bethel.K-12.or.us/schools/shasta/shastaplan.html.

http://www.puhsd.K-12.ca.us/staffdev/quickguide.html.

http://www.tilc.com/academy/courses.html.

Status of Various Southern California

K-6 Science/Technology/Computer Programs

According to Benson (1996), California ranks at the bottom of the nation for its technology in schools. In order for Southern California schools (i.e., Los Angeles County and Orange County) to catch-up to the rest of the nation, there are a few issues which must be addressed. First of all, the funding to train the teachers appropriately in the field of educational technology and to keep their skills and knowledge current, must be made available. Second, the necessary software and hardware (i.e., computers, peripherals, and software programs) must be made available for the teachers to use during their technology lessons with their students. If these two areas of concern are addressed properly, students' technology education will be greatly improved in Southern California.

The problem concerning the lack of technology teacher training became evident after the National Education Commission (NEC) had conducted a survey. According to the NEC, teachers said that a lack of time, training, and knowledge far outweighed the lack of funding as the major reason that they were not using computers, on-line services, cable television, CD-ROMs, laser disks, and the global computer network Internet in their classrooms (Aversa, 1995).

The NEC did discover, however, that 85% of teachers had used computers in the classroom during the past year—a level of use which was far greater than what many educational officials said that they had expected. Fifty-eight percent of

the teachers said that they had used educational cable programs in the classroom during the last year, but few teachers had taken advantage of the Internet and on-line services during the same period (Aversa, 1995). The NEC survey, according to Aversa (1995), was based on 1,000 telephone interviews of elementary and secondary school teachers, media coordinators, and administrators, and was conducted in April and May of 1995. The survey had a margin of error of plus or minus three percentage points.

Another survey, conducted by a company called Market Data Retrieval (MDR), yielded the conclusion that one-third of all K-12 public schools were on-line. MDR surveyed 67,000 public schools between November 1995 and June 1996. A 40% response rate from nearly 27,000 schools was yielded from direct mail and phone queries. The schools that responded to the survey accounted for 38% of the 44.4 million students attending public schools during the 1995-1996 school year (Leiken, 1996).

According to Leiken (1996), some other important MDR findings were the following:

- Less than 30% of elementary schools used the Internet; whereas 43% of all high schools did.

- The size of the school was directly proportionate to the amount of Internet use. The larger the school, the more likely it was to be using the Internet.

Schools which had more than 500 students had access to the Internet at an above-average rate.

- School districts with higher incomes had Internet access at an above-average rate.

- A very strong correlation was evident between the rate of Internet access and the total number of computers in a school. Schools that had at least 50 computers used the Internet more than 41% of the time; whereas only 13% of schools with four or fewer computers used the Internet.

- The school was more likely to have Internet access as the student-to-computer ratio became more favorable.

- The technology coordinators reported that the Internet was being used mostly for research, and 60% of the districts were using the Internet for communications. Over 33% of the schools had integrated the Internet into their curriculum.

According to Vranizan (1994), optimists predicted that soon students across the nation would use hardware to tap into interactive libraries half-way around the world, team-up on projects with students at other schools, and take specialty classes from master teachers in other parts of the state.

There have been a few Orange County schools that have been testing interactive services with encouraging results. Breakthroughs, such as Pacific Bell's

plan to spend $150 million to put public schools on its interactive network, have been a step in a positive direction (Vranizan, 1994).

According to Vranizan (1994), teachers at Trabucco Hills High School in Mission Viejo, California have tapped into the Internet. Students have logged on during computer classes. A few of the students have used the Internet to communicate with students in Sri Lanka and Iran. Unfortunately, most of the institutions have not had the money to pay for the basics, let alone expensive computer hardware. Teaching materials, software, cable programs, and the on-line services have been scarce.

San Diego Principal - Proponent of Technology. With the advent of technology, many new teacher-training techniques have been developed. One such example is Clear View Elementary School in San Diego, California. According to Kamil (1995), Clear View Elementary School has had over 3,000 visitors since it opened in September 1991. The school has been a model of successful innovative instruction. Classrooms of two demonstration teachers at Clear View School were observed through one-way mirrors by aspiring teachers and administrators. The observers were able to learn about the behaviors of children without intimidating them with their presence. Observations included everything from whether children could work together in groups without the supervision of a teacher, to the enthusiasm exhibited when students first discovered the Internet.

As quoted by Kamil (1995), Ginger Hovenic, Principal of Clear View Elementary School, stated in an interview that "Our job as educators is to provide an environment for exploration" (p. 2). When Hovenic first accepted the job of principal in 1991, she wanted to make technology an integral part of the curriculum. Hovenic, as quoted by Kamil (1995), stated that:

> Because of the technology here and because of what our kids have been exposed to, they're pushing the bar at the middle school. So part of our funding is to pay for substitute teachers so that teachers from the middle school can come to see what's going on here and understand why our kids are different. Our kids don't want to just sit in rows and read a book. They want to talk about it, give their opinion, and produce things. Now these kids are having the same effect at the high school level. Let's raise the bar for all kids. (p. 2)

Hovenic noted that *raising the bar* is not cheap: it requires money for training teachers and money for technology. As quoted by Kamil (1995), Hovenic stated that:

> A year and a half ago we had only two teachers who even knew how to turn on a computer, but the non-personnel budget for the school year is only $16,000. That's $16,000 for pencils, paper, cleaning supplies, toilet paper—everything. (p. 2)

Funding Sources for LAUSD Technology Training Centers

The California Technology Teacher Training Centers (CTTTCs) involved in this study are part of the Los Angeles Unified School District (LAUSD). Funding for the Los Angeles Unified School District Technology Training Centers is

provided by numerous sources. According to R. Archerd (personal

communication, April 29, 1997), C. Holle (personal communication, May 2, 1997),

and D. Smedley (personal communication, April 28, 1997), funding for the Los

Angeles Unified School District Technology Training Centers has been provided by

the following sources:

1. The National Science Foundation (NSF) Grant, which is funded by the

   federal government.

2. The Eisenhower Entitlement Grant, which is funded by the federal

   government through the state.

3. Block Grants, which are funded by the state government and allocated to

   the district.

4. District General Funds, which are funded by local property taxes and state

   taxes.

5. Bilingual Funds, which are funded by the state and federal governments.

6. Chapter 1 Funds, which are funded by the federal government.

7. School Improvement Funds, which are funded by the state government.

8. Private donations.

Knowledge Gaps about CTTTCs

(Statement of the Problem Situation)

General research has been inconclusive regarding the role that computers

play in effective educational programs. Also, because of a lack of research

information, it is currently difficult to assess whether CTTTCs are perceived as effectively training teachers to teach their students about science/technology/ computers. It is also unclear whether the training centers have set objectives to measure their success accurately. In essence, the training centers are currently unaware if what they are teaching the teachers during the science/ technology/computer training sessions is actually being used in the classroom, and is being taught to the children. Therefore, it is unclear whether the training centers are accomplishing their goals.

CHAPTER 3

METHODOLOGY

This chapter includes the methods and procedures used in this study. The basic purpose of this study was to investigate the perceived effects of California Technology Teacher Training Centers (CTTTCs) on K-6 teachers'/students' science/technology/computer learning. The data for this study were obtained from three different sources: information gathered from the CTTTC teachers, from the CTTTC-trained teachers, and from the K-6 students trained by the CTTTC-trained teachers.

Procedure

A descriptive research design was used in this study. It included the following phases:

Phase 1 (Pilot Group)

A randomly selected CTTTC was used in the pilot study. The randomly selected CTTTC was from one of the five CTTTCs in the LAUSD, where the CTTTCs involved in this study were located. Questionnaires and follow-up interview questions for the pilot group involved one volunteer CTTTC teacher, one volunteer K-6 CTTTC-trained teacher, and two volunteer K-6 students instructed by their CTTTC-trained teacher. This pilot sample was used to insure that the

intent of the questionnaires and the follow-up interview questions were communicated effectively. The comments from the pilot group were incorporated into the final questionnaires and into the follow-up interview questions used in this study.

Phase 2 (Participating Groups)

After the questionnaires and follow-up interview questions had been modified per the comments made by the pilot group, the questionnaires and follow-up interview questions were administered to the following groups of people:

CTTTC-Program Teachers. Two CTTTC-program teachers from each of five different CTTTCs completed questionnaires (Appendix A). When necessary, the CTTTC-program teachers were asked to answer follow-up interview questions after they had completed their questionnaires. The pilot group data were deemed invalid; therefore, the pilot group data were discarded. A different training class from the pilot CTTTC was chosen for the study.

CTTTC-Trained Teachers. Six CTTTC-trained teachers from each of five different CTTTCs answered items in a portion of their questionnaires directly after the completion of their CTTTC classes. Another portion of their questionnaires was completed after they had taught their K-6 students about the information that they had learned at the CTTTC (Appendix B). When necessary, follow-up interview questions were discussed with the teachers after they had completed the second portion of their questionnaires.

K-6 Students Trained by the CTTTC-Trained Teachers. Two students

from each of the 30 K-6 CTTTC-trained teachers' classrooms completed a

questionnaire directly after the concept had been taught to them by their CTTTC-

trained teachers (Appendix C). When necessary, follow-up interview questions

were discussed with the students after they had responded to their questionnaires.

There was a cover letter distributed with each one of the CTTTC-program

teachers' and the K-6 CTTTC-trained teachers' questionnaires explaining the intent

of this study (Appendix D).

Phase 3 (Concluding Steps)

The study results were provided to all individuals who had requested a copy

of the results. The data were analyzed by grouping the common information

together and developing conclusions from those data.

Conclusions were drawn from the data supplied by the 10 CTTTC teachers,

the 30 CTTTC-trained teachers, and the 60 K-6 students (two students for each of

the 30 teachers) trained by the CTTTC-trained teachers. Follow-up calls were

made when clarification of answers were needed.

Sample Selection

As stated previously, the following groups completed questionnaires and

participated in follow-up interviews to generate the data for this investigation:

Ten CTTTC-program teachers (two teachers from each of the five CTTTCs) completed a questionnaire and, when necessary, participated in a follow-up interview after completing the instruction of their courses.

Thirty teachers who had been trained by the various CTTTCs (six teachers from each of the five CTTTCs) completed one portion of their questionnaires directly after having taken a science/technology/computer-related training course at a CTTTC. Items in another portion of the questionnaire were answered directly after the CTTTC-trained teachers had instructed their K-6 students about the concept that they had learned in the CTTTCs. When necessary, follow-up interviews were performed after the teachers had completed the second portion of their questionnaires.

Sixty K-6 students who had been taught by the CTTTC-trained teachers (two students from each of the 30 CTTTC-trained teachers' classrooms) completed questionnaires. When necessary, they participated in a follow-up interview after their questionnaires had been completed.

Instrumentation

The inquiries listed on the questionnaires and the follow-up interview questions, involving the three groups of subjects, were as follows:

CTTTC-Program Teachers

The following questions were answered by the CTTTC-program teachers after the classroom information had been presented to the K-6 teachers by the CTTTC-program teachers (Appendix A):

Date? Name?

Phone Number? (If clarification of questionnaire responses is necessary)

Location of training center?

What is the subject of your training class?

Have you taught this training class before? Explain.

How many teachers were present in your training class?

Did you have any goals and objectives planned for the teachers in your class? Explain.

Did you have any goals and objectives planned for your class with regards to what the teachers will eventually teach to their students in the classroom? Explain.

Did you inquire as to whether the teachers understood the material taught to them in your training class? Explain.

Did you inquire as to whether the teachers planned on using the information that was taught to them in the training class to teach their students? Explain.

Are you experiencing any budget problems in the area of teacher training? Explain.

Are you aware of any technology support problems (i.e., lack of computers, science equipment, etc.) that the teachers may be experiencing in their classrooms? Explain.

Can you think of any areas that you can improve that would assist your students in understanding the topics more easily and more effectively? Explain.

Did you use any science/technology/computer equipment to help your students learn the material easier? Explain.

Do you have the necessary science/technology/computer equipment in your classroom to teach your students effectively? Explain.

Follow-up interview questions were answered by the CTTTC-program teachers after they had completed their questionnaires.

Teachers Trained in the CTTTCs

Part I, consisting of the following questions, was completed by the teachers trained in the CTTTCs, immediately after the classroom information had been presented to them by the CTTTC-program teachers. Part II, consisting of the following questions, was completed by the teachers trained in the CTTTCs, immediately after they had taught their students the information that they had learned in the CTTTCs (Appendix B for Parts I and II).

Part I (Completed by the K-6 Teachers Directly After the Completion of Their CTTTC-Training Classes). The following questions were answered by the K-6 teachers:

Date? Name?

Phone Number (If clarification of questionnaire responses is necessary)?

From which training center did you receive your training?

What was the topic that you learned in your training class?

Prior to attending the training class, were you aware of the subject that you learned in your training class? Explain.

Did you understand the information taught to you in the training class? Explain.

Were the objectives, goals, and requirements of the training class course well defined and specific? Explain.

Do you feel that the course attained its objectives? Explain.

Do you feel that you will be able to incorporate what you learned in the training course into your lesson plan? Explain.

Was the subject matter presented by the training class instructor effectively? Explain.

Did the training class instructor exhibit a broad background and knowledge of the subject matter? Explain.

Were the materials used in the training class (handouts, films, etc.) useful? Explain.

Do you feel that the training class prepared you to train your students in the subject matter effectively? Explain.

Do you have any advice for the training centers which may help them improve their teaching methods and effectiveness? Explain.

Do you have a method of determining whether your students understand the material that you teach them? Explain.

Do you plan on using any science/technology/computer equipment to help your students learn the material easier? Explain.

Do you have the necessary science/technology/computer equipment in your classroom to teach the children effectively? Explain.

Do the children in your classroom get "hands on" experience with any science/technology/computer equipment? Explain.

Did the training class meet your expectations? Explain.

Would you recommend this class to your fellow teachers? Explain.

Do you have any suggestions of how to improve the effectiveness of the training class that you attended? Explain.

Should the training class be offered again? Explain.

Have you experienced any peer coaching since the completion of your training class? Explain.

Do you think that peer coaching would have helped you? Explain.

Use a scale from 1 to 10 (10 being most important) to associate your level of importance for each of the following concepts:

Local staff members should always be available for follow-up help, even when outside consultants are used for workshops. Ranking. Explain.

After teachers complete their workshops, they should have easy access to the same tools that they used in their training class. Ranking. Explain.

Teachers should always be the primary trainers of teachers. Ranking. Explain.

The teacher training should always be directly tied to classroom/curriculum/school reform objectives. Ranking. Explain.

Learning to use science/technology/computers is not voluntary, it's required. Ranking. Explain.

Administrators (i.e., principals, superintendents, etc.) should attend the staff development courses along with their teachers. Ranking. Explain.

Time is made available in the teachers' work schedules for staff development. Ranking. Explain.

Part II (Completed by the K-6 Teachers Directly After They Had

Taught Their K-6 Students About the Information That They Had Learned

at the CTTTCs). The following questions were answered by the K-6 teachers:

Did you teach your students about the concept that you learned in your training class? Explain.

What was the topic that you taught to your students?

Did your students appear to understand the concept that you taught them? Explain.

Do you feel that the training center prepared you to teach your students effectively about the topic that you learned in the training class that you attended? Explain.

How could the training center have better prepared you to teach your students about the subject that you taught to your students? Explain.

Do you feel that the training class prepared you to train your students in the subject matter effectively? Explain.

Do you have any advice for the training centers which may help them improve their teaching methods and effectiveness? Explain.

Did you use any science/technology/computer equipment to help your students learn the material easier? Explain.

Did the children in your classroom get "hands on" experience with any science/technology/computer equipment? Explain.

Follow-up interview questions were asked after the K-6 teachers completed

Part II of their questionnaires.

K-6 Students Taught by the Teachers Trained in the CTTTCs

The following questions were answered by the K-6 students after the classroom information had been presented to the K-6 students by their CTTTC-trained teachers (Appendix C).

Date?

What is your teacher's name?

What grade are you in?

What was the topic that you learned from your teacher?

Did you understand the topic that your teacher taught you in class? Explain.

Were you already aware of the topic that your teacher taught you prior to hearing it from your teacher? Explain.

Did you enjoy learning about the topic that your teacher taught you? Explain.

Did you use any computer equipment to learn the material? Explain.

Do you think that the information that your teacher taught you would have been easier to learn if you used a computer or the Internet? Explain.

Do you have the necessary computer equipment in your classroom to learn the topic that your teacher taught you? Explain.

Did you get "hands on" experience with any computer equipment? Explain.

Do you plan on using the information that you learned in class in the future? Explain.

What could your teacher have done differently to more effectively teach you about the topic that you learned in class?

Follow-up interview questions were asked after the K-6 students'

questionnaires had been completed.

Data Collection

The questionnaires and follow-up interview questions involving the

previously cited 10 CTTTC teachers, the 30 K-6 CTTTC-trained teachers, and the

60 K-6 students trained by the CTTTC-trained teachers were collected in the

following ways:

CTTTC instructors ($N = 10$): The questionnaires were distributed and

collected directly after the completion of the training class. Follow-up questions

were asked after the questionnaires had been completed.

CTTTC-trained teachers ($N = 30$): One portion of the questionnaire was

completed directly after the completion of the training class. Another portion of

the questionnaire was answered directly after the CTTTC-trained teachers had

explained the concepts learned in the CTTTC to their students. Follow-up

questions were asked after the questionnaires had been completed.

K-6 students trained by the K-6 CTTTC-trained teachers ($N = 60$): The

questionnaires were distributed and collected directly after the CTTTC-trained

teachers had explained the concepts learned in the CTTTC to their students.

Follow-up questions were asked after the questionnaires had been completed.

Data Analysis

The data were analyzed by grouping the common information and developing conclusions from those data. Frequency and percentages of responses to questionnaire items were reported in tabular form. No attempt was made to formulate statistical inferences from the data.

Summary

This study was conducted to explore the perceived effectiveness of CTTTCs on K-6 teachers'/students' science/technology/computer learning. Members of the target population of the study, which consisted of the 10 CTTTC teachers, the 30 teachers who had been trained in the various CTTTCs, and the 60 students who had been taught by the teachers trained in the CTTTCs, were all from California K-6 public educational schools.

CHAPTER 4

FINDINGS

Only minimal data was available regarding the effectiveness of CTTTCs. The results of this study provide a means to determine whether CTTTCs are effectively training California teachers, whether the teachers are learning and using the information acquired in the CTTTC classes to train their students in the classroom, and whether the students are better able to learn information taught by CTTTC-trained teachers. The findings of this study may indicate whether funding problems have had a perceived influence on the effectiveness of the CTTTCs.

The purpose of this study was to determine whether the current CTTTCs are effectively training California's K-6 teachers in the areas necessary to teach science/technology/computers to their students as perceived by the CTTTC instructors and the K-6 CTTTC-trained teachers.

This chapter reports the information gathered from the following groups of subjects:

Ten CTTTC-program teachers (two teachers from each of the five CTTTCs) completed a questionnaire and, when necessary, participated in a follow-up interview after completing the instruction of their courses. Appropriate statistical information is reported in Table 5.

Table 5

Data From the CTTTC-Program Teachers

Questionnaire Questions	Yes	No
1. Question: Have you taught this class before?	80%	20%
2. Question: Did you have any goals and objectives planned for the teachers in your class?	100%	0%
3. Question: Did you have any goals and objectives planned for your class with regards to what the teachers will eventually teach to their students in the classroom?	100%	0%
4. Question: Did you inquire as to whether the teachers understood the material taught to them in your training class?	80%	20%
5. Question: Did you inquire as to whether the teachers planned on using the information that was taught to them in the training class to teach their students?	70%	30%
6. Question: Are you experiencing any budget problems in the area of teacher training?	60%	40%
7. Question: Are you aware of any technology support problems (i.e., lack of computers, science equipment, etc.) that the teachers may be experiencing in their classrooms?	100%	0%

Response: All of the instructors were aware that the teachers lacked equipment and computer support. In most classes the ratio is thought to be 15 students per computer. It was thought that less than 5% of the teachers being trained in the CTTTCs had Internet access.

Table 5 (continued)

Questionnaire Questions	Yes	No

8. Question: Can you think of any areas that you can improve that would assist your students in understanding the topics more easily and more effectively?   100%   0%

    Breakdown:

    60% better class supplies (computers, Internet access, etc.)
    20% more time for questions and answers
    20% class materials were outdated, need to be more modern

9. Question: Did you use any science/technology/computer equipment to help your students learn the material easier?   40%   60%

10. Question: Do you have the necessary science/technology/ computer equipment in your classroom to teach your students effectively?   40%   60%

    Breakdown:

    60% of the CTTTC classrooms didn't have a computer in the classroom
    40% of the CTTTC classrooms had too few computers to use them
        effectively during the lecture

Note: Two teachers from each of the five CTTTCs were involved in this portion of the study.

Thirty teachers who had been trained by the various CTTTCs (six teachers from each of the five CTTTCs) completed one portion of their questionnaires directly after having taken a science/technology/computer-related training course at a CTTTC. Items in another portion of the questionnaire were answered directly after the CTTTC-trained teachers had instructed their K-6 students about the concept that they had learned in the CTTTCs. When necessary, follow-up interviews were performed after the teachers had completed the second portion of their questionnaires. Appropriate statistical information is reported in Table 6.

Sixty K-6 students who had been taught by the CTTTC-trained teachers (two students from each of the 30 CTTTC-trained teachers' classrooms) completed questionnaires. When necessary, they participated in a follow-up interview after their questionnaires had been completed. Appropriate statistical information is reported in Table 7.

Table 6

Data From the K-6 Teachers Trained at the CTTTCs

Questionnaire Questions/Concepts	Yes	No
1. Question: Prior to attending the training class, were you aware of the subject that you learned in your training class?	90%	10%
2. Question: Did you understand the information taught to you in the training class?	100%	0%
3. Question: Were the objectives, goals, and requirements of the training class course well defined and specific?	93%	7%
4. Question: Do you feel that the course attained its objectives?	93%	7%
5. Question: Do you feel that you will be able to incorporate what you learned in the training course into your lesson plan?	90%	10%
6. Question: Was the subject matter presented by the training class instructor effectively?	93%	7%
7. Question: Did the training class instructor exhibit a broad background and knowledge of the subject matter?	87%	13%
8. Question: Were the materials used in the training class (handouts, films, etc.) useful?	97%	3%
9. Question: Do you feel that the training class prepared you to train your students in the subject matter effectively?	87%	13%
10. Question: Do you have any advice for the training centers which may help them improve their teaching methods and effectiveness?	53%	47%

The following list includes some of the advice provided by the teachers:

Table 6 (continued)

Questionnaire Questions/Concepts	Yes	No

- Present the subject to 1 or 2 grade levels, rather than 5 or 6 different grade levels.
- Waste less time in class and offer more exposure to ideas.
- Start and finish training classes on time.
- Encourage training centers to offer follow-up assistance concerning the more difficult training topics.
- Provide more communication through flyers that can be posted at school sites.
- Offer more training centers and more classes at the training centers.
- Furnish access to computers and Internet in the classrooms.
- Provide student samples and examples of products.
- Make available materials in Spanish.
- Provide more reference materials of student output.

11. Question: Do you have a method of determining whether your students understand the material that you teach them?   100%   0%

- Play "game show"; students receive prizes/stickers for correct answers
- Pre-test, teach, post-test

12. Question: Do you plan on using any science/technology/ computer equipment to help your students learn the material easier?   53%   47%

13. Question: Do you have the necessary science/technology/ computer equipment in your classroom to teach the children effectively?   37%   63%

14. Question: Do the children in your classroom get "hands on" experience with any science/technology/computer equipment?   70%   30%

15. Question: Did the training class meet your expectations?   83%   17%

Table 6 (continued)

Questionnaire Questions/Concepts	Yes	No

16. Question: Would you recommend this class to your fellow teachers? — 93% 7%

17. Question: Should the training class be offered again? — 93% 7%

18. Question: Have you experienced any peer coaching since the completion of your training class? — 13% 87%

19. Question: Do you think that peer coaching would have helped you? — 57% 43%

The next section of the questionnaire asked the participant to associate his/her level of importance (1 to 10, 10 being most important) for each of the following concepts:

20. Concept: Local staff members should always be available for follow-up help, even when outside consultants are used for workshops. **Average Ranking – 6.77**

21. Concept: After teachers complete their workshops, they should have easy access to the same tools that they used in their training class. **Average Ranking – 8.80**

22. Concept: Teachers should always be the primary trainers of teachers. **Average Ranking – 7.70**

23. Concept: The teacher training should always be directly tied to classroom/curriculum/school reform objectives. **Average Ranking – 8.67**

24. Concept: Learning to use science/technology/computers is not voluntary, it's required. **Average Ranking – 7.66**

25. Concept: Administrators (i.e., principals, superintendents, etc.) should attend the staff development courses along with their teachers. **Average Ranking – 7.17**

26. Concept: Time is made available in the teachers' work schedules for staff development. **Average Ranking – 8.30**

Table 6 (continued)

The next section of the questionnaire was completed after the concept learned in the CTTTCs had been taught to their K-6 students in the classroom.

Questionnaire Questions/Concepts	Yes	No
27. Question: Did you teach your students about the concept that you learned in your training class?	100%	0%
28. Question: Did the students appear to understand the concept that you taught them?	100%	0%
29. Question: Do you feel that the training center prepared you to teach your students effectively about the topic that you learned in the training class that you attended?	77%	23%
30. Question: Do you feel that the training class prepared you to train your students in the subject matter effectively?	83%	17%
31. Question: Did you use any science/technology/computer equipment to help your students learn the material easier?	20%	80%
32. Question: Did the children in your classroom get "hands on" experience with any science/technology/computer equipment?	23%	77%

Note: Three K-6 teachers from each of the 10 CTTTC-training classes were involved in this portion of the study.

Table 7

Data From the K-6 Students Taught by the CTTTC-Trained K-6 Teachers

Questionnaire Questions	Yes	No
1. Question: Did you understand the topic that your teacher taught you in class?	100%	0%
2. Question: Were you already aware of the topic that your teacher taught you prior to hearing it from your teacher?	43%	57%
3. Question: Did you enjoy learning about the topic that your teacher taught you?	97%	3%
4. Question: Did you use any computer equipment to learn the material?	15%	85%
5. Question: Do you think that the information that your teacher taught you would have been easier to learn if you used a computer or the Internet?	45%	55%
6. Question: Do you have the necessary computer equipment in your classroom to learn the topic that your teacher taught you?	28%	72%
7. Question: Did you get "hands on" experience with any computer equipment?	42%	58%
8. Question: Do you plan on using the information that you learned in class in the future?	88%	12%

Table 7 (continued)

<u>Questionnaire Questions</u>   <u>Yes</u>   <u>No</u>

9. Question: What could your teacher have done differently to more effectively teach you about the topic that you learned in class?

      Student comments:

      Make available computers and Internet access.

      Use the encyclopedia during the lecture.

      Incorporate the topic into a game.

      Organize a field trip to a related area.

      Plan a museum trip.

      Research/write a report on the subject.

Note: Two students from each of the 30 CTTTC-trained teachers' classrooms were involved in this portion of the study.

Selected Findings Related to the Research Questions

The following section lists the four research questions based on the

information provided by responses to selected items in the three questionnaire

forms:

Research Question 1

Research Question 1 inquired as to how effective the CTTTCs had been in

training K-6 teachers, as perceived by the 10 CTTTC instructors. Supporting data

are reported in Tables 5 and 6. According to the research uncovered by the

questionnaires, 80% of the CTTTC instructors reported that they had inquired as to

whether the teachers understood the material taught to them in their training classes

(Table 5, Question 4). Seventy percent of the CTTTC instructors declared that

they had inquired as to whether the teachers planned on using the information that

had been taught to them in their training classes to teach their students (Table 5,

Question 5).

The study also revealed that it was the understanding of the CTTTC

instructors that every K-6 teacher trained in the CTTTCs was having technology

support problems in his or her classroom (Table 5, Question 7). CTTTC

instructors, aware of this problem, taught their classes accordingly. Over half of

the CTTTC instructors stated that access to computers and the Internet would

definitely assist the K-6 teachers in learning the information taught in the CTTTCs

(Table 5, Question 8). More importantly, access to computers and to the Internet would be, in the view of this researcher, a great tool for the K-6 teachers to use while teaching their K-6 students.

Ninety-three percent of the teachers trained in the CTTTCs stated that the objectives, goals, and requirements of the training course were well defined and specific (Table 6, Question 3). It follows that the same 93% of the participants reported that the course had attained its objectives (Table 6, Question 4).

Ninety percent of the teachers stated that they would be able to incorporate what they had learned in class into their lesson plans (Table 6, Question 5). Even after teaching their K-6 students about the CTTTC information, 83% of the teachers indicated that the CTTTCs had adequately prepared them to train their students in the subject matter effectively (Table 6, Question 30). In order to improve the teaching methods of the training centers, the CTTTC teachers themselves had the following advice regarding their own CTTTC classes: (a) 60% of the teachers declared that better supplies (computers, Internet access, etc.) would have helped in the teaching process, (b) 20% of the teachers indicated that they desired more time for questions and answers, and (c) another 20% stated that the class materials were outdated (Table 5, Question 8).

Research Question 2

Research Question 2 complemented Research Question 1 by determining whether the goals and objectives of the CTTTCs had been met, as perceived by the 10 CTTTC instructors. Supporting data are reported in Tables 5 and 6. According to the research uncovered by the questionnaires, 100% of the CTTTC teachers stated that they had goals and objectives planned for the K-6 teachers (Table 5, Question 2). One-hundred percent of the CTTTC teachers also stated that they had goals and objectives planned for their classes with regard to what the K-6 teachers would eventually teach to their students in the classroom (Table 5, Question 3).

Once again, 100% of the CTTTC instructors reported that they were aware that every K-6 teacher trained in the CTTTCs was having technology support problems in their classrooms (Table 5, Question 7). Once again, over half of the CTTTC instructors stated that access to computers and the Internet would definitely assist the K-6 teachers in learning the information taught in the CTTTCs (Table 5, Question 8). More importantly, access to computers and to the Internet would be, in the view of this researcher, a great tool for the K-6 teachers to use while teaching their K-6 students.

Eighty-seven percent of the teachers instructed in the training classes stated that the training class had prepared them to train their students in the subject matter effectively (Table 6, Question 9). The K-6 teachers declared (with an average of 8.8 points, where 10 is the highest score) that once they had completed their

workshops at the CTTTCs, they should have easy access to the same tools that they had used in their training classes (Table 6, Question 21). The K-6 teachers who had been trained in the CTTTCs gave the following advice for the training centers: (a) present the subject to teachers at 1 or 2 grade levels, rather than to teachers at 5 or 6 different grade levels; (b) waste less time in class and offer more exposure to ideas; (c) start and finish training classes on time; (d) encourage training centers to offer follow-up assistance concerning the more difficult training topics; (e) provide more communication through flyers that can be posted at school sites; (f) offer more training centers and more classes at the training centers; (g) furnish access to computers and Internet in the classrooms; (h) provide student samples and examples of products; (i) make available materials in Spanish; and (j) provide more reference materials of student output (Table 6, Question 10).

Research Question 3

Research Question 3 inquired as to how effective the 30 CTTTC-trained K-6 teachers had been in teaching their 60 K-6 students the information learned in the CTTTCs, as perceived by both the K-6 teachers and the K-6 students themselves. Relevant statistical information is reported in Tables 6 and 7. According to the research uncovered by the questionnaires, 100% of the K-6 teachers commented that it appeared that their K-6 students understood the concept that had been taught to them (Table 6, Question 28). Teachers reported having endeavored to determine

whether their K-6 students had understood the topic by testing the students'

knowledge prior to, and after, teaching them the CTTTC-related topic (Table 6,

Question 11). Teachers also stated that they had played games to determine

whether the students understood the information taught to them. Many declared

that they had rewarded the students with prizes and stickers when answering the

questions correctly.

Almost half of the K-6 students stated that the information would have been

much easier to learn if computers and the Internet had been accessible in the

classroom (Table 7, Question 5). One hundred percent of the students commented

that they had understood the topic that their teacher had taught them in class (Table

7, Question 1). To assist their teachers on instructing them in the classroom, the K-

6 students offered other suggestions: (a) make available computers and Internet

access, (b) use the encyclopedia during the lecture, (c) incorporate the topic into a

game, (d) organize a field trip to a related area, (e) plan a museum trip, and (f)

research and write a report on the subject (Table 7, Question 9).

Research Question 4

Research Question 4 complemented Research Question 3 by determining

whether the goals and objectives of the CTTTC-trained K-6 teachers had been met,

as perceived by both the K-6 teachers and the K-6 students themselves. Supporting

data are reported in Tables 6 and 7. According to the research uncovered by the

questionnaires, 87% of the teachers commented that the training center had prepared them to teach their students effectively about the topic that they had learned in the training class that they had attended (Table 6, Question 9). Even after teaching their K-6 students about the CTTTC information, 83% of the teachers indicated that the CTTTCs adequately prepared them to train their students in the subject matter effectively (Table 6, Question 30). As stated previously, almost half of the K-6 students indicated that the information would have been much easier to learn if computers and the Internet had been accessible in the classroom (Table 7, Question 5). Even though 100% of the students commented that they had understood the topic that their teacher had taught them in class (Table 7, Question 1), nearly half of the students indicated that availability of computers and Internet access would have helped them learn the topic more easily (Table 7, Question 9).

CHAPTER 5

DISCUSSION OF CONCLUSIONS, RECOMMENDATIONS,

AND IMPLICATIONS

This chapter consists of the following sections: introduction, problem addressed, purpose of the study, methodology, conclusions, recommendations, and implications.

Only minimal data was available regarding the effectiveness of CTTTCs. The results of this study provide a means to determine whether CTTTCs are effectively training California teachers, whether the teachers are learning and using the information acquired in the CTTTC classes to train their students in the classroom, and whether the students are better able to learn information taught by CTTTC-trained teachers. The findings of this investigation may indicate whether funding problems have had a perceived influence on the effectiveness of the CTTTCs.

Problem Addressed

General research was inconclusive regarding the role that computers play in effective educational programs. Also, because of lack of research information, it is currently difficult to assess whether CTTTCs are perceived as effectively training teachers to instruct their students about science/technology/computers. It is also

unclear whether the training centers have set objectives to measure their success accurately. In essence, the training centers are currently unaware if what they are teaching to the classroom instructors during the science/technology/computer training sessions is actually being used in the classroom, and is being taught to the children. Therefore, it is unclear whether the training centers are accomplishing their goals.

Purpose of the Study

The purpose of this study was to determine whether the current CTTTCs are effectively training California's K-6 teachers in the areas necessary to teach science/technology/computers to their students as perceived by the CTTTC instructors, the K-6 CTTTC-trained teachers, and the K-6 students themselves.

Methodology

The data for this study were gathered from three different areas. Information was obtained from the CTTTC teachers, from the CTTTC-trained teachers, and from the K-6 students trained by the CTTTC-trained teachers.

As stated previously, the following groups completed questionnaires and participated in follow-up interviews to generate the data for this investigation:

Ten CTTTC-program teachers (two teachers from each of the five CTTTCs) completed a questionnaire and, when necessary, participated in a follow-up interview after completing the instruction of their courses.

Thirty teachers who had been trained by the various CTTTCs (six teachers from each of the five CTTTCs) completed one portion of their questionnaires directly after having taken a science/technology/computer-related training course at a CTTTC. Items in another portion of the questionnaire were answered directly after the CTTTC-trained teachers had instructed their K-6 students about the concept that they had learned in the CTTTCs. When necessary, follow-up interviews were performed after the teachers had completed the second portion of their questionnaires.

Sixty K-6 students who had been taught by the CTTTC-trained teachers (two students from each of the 30 CTTTC-trained teachers' classrooms) completed questionnaires. When necessary, they participated in a follow-up interview after their questionnaires had been completed.

Selected Conclusions

The following selected conclusions arose from the data analysis based on the perceptions of the study participants:

1. According to the information provided in Tables 5 and 6, it appeared that the CTTTC instructors had been training the K-6 teachers effectively.

2. In light of the data presented in Tables 5 and 6, it was evident that the goals and objectives of the CTTTC instructors had been planned and met reasonably well.

3. In terms of the information set forth in Tables 6 and 7, it seemed that the CTTTC-trained K-6 teachers had been instructing their K-6 students effectively.

4. From the results reported in Tables 6 and 7, the goals and objectives of the CTTTC-trained K-6 teachers had been achieved realistically well.

5. The CTTTC instructors may be expected to learn from the advice provided by the CTTTC-trained K-6 teachers (Table 6, Question 10).

6. The CTTTC-trained K-6 teachers should be anticipated to learn from the experiences communicated by the K-6 students (Table 7, Question 9).

7. It became evident, by the high score values assigned by the CTTTC-trained K-6 teachers, that they had strongly requested access to the same tools in their K-6 classrooms as those that they had used in their CTTTC-training classes (Table 6, Question 21).

8. In view of the information in Tables 6 and 7, the K-6 students apparently understood the concepts that had been taught to them by their K-6 CTTTC-trained teachers (Table 7, Question 1).

9. The CTTTC instructors unanimously perceived that every K-6 teacher trained in the CTTTCs had technology support problems (Table 5, Question 7).

10. The CTTTC instructors tended to agree that access to computers and the Internet would definitely assist the K-6 teachers in learning the information taught in the CTTTCs (Table 5, Question 8).

Recommendations

The following recommendations arose from the findings:

1. The CTTTC instructors should continue to set goals and objectives for the teachers trained in the CTTTCs. Clear goals and objectives are essential to a successful training class.

2. The CTTTC instructors should continue to set goals and objectives regarding what the teachers eventually teach to their students in the classroom. The K-6 students are the end-receivers of the training information; therefore, it is essential that the CTTTC instructors consider this fact.

3. The K-6 teachers should continue to attend classes offered at the CTTTCs. The CTTTCs have been shown to be effective, as evidenced by the questionnaire results. Therefore, K-6 teachers should take advantage of this opportunity.

4. Additional funding should be allocated to the CTTTCs. The teachers need more computers in the classrooms and access to information on the Internet.

5. Additional resources should be allocated to the LAUSD K-6 classrooms so that students may have access to more computers in the classroom and to information on the Internet.

6. Access to computers and to the Internet would be, in the view of this researcher, a great tool for the K-6 teachers to use while teaching their K-6 students.

A replication of this study should be used in future research related to this topic. Future researchers should analyze whether science/technology/computer teacher training centers throughout the rest of California, as well as the United States, are effectively training K-6 teachers, whether the K-6 teachers are learning and using the information learned in the training classes to instruct their students in the classroom, and whether the students are better able to learn information taught by their technology-trained teachers than by teachers employing traditional approaches. Additional research should also uncover whether funding problems have had an influence on the outcomes of studies throughout the entire State of California, and in a broader sense, throughout the entire country.

Additional investigations should be performed to determine whether technology funding problems have been a concern for the rest of the *State of California*, or whether they have been unique to LAUSD training centers and schools.

Additional studies should be performed to determine whether technology funding concerns are a *national problem*, or whether they have been limited to LAUSD and other California training centers and schools.

A study of the LAUSD budget should be conducted to analyze whether funding may be redistributed to accommodate the technology needs of both CTTTCs and the K-6 classrooms. Neither the CTTTCs nor the K-6 teachers' classrooms are adequately equipped with computers and with the Internet to train their students effectively. This study revealed that computers and the Internet have been important tools for both the CTTTCs and the K-6 classrooms.

Implications

There are currently limited data regarding the effectiveness of CTTTCs. It has become evident, after analyzing the results of the questionnaires, that CTTTCs are effectively training their students to the best of their capabilities. Unfortunately the findings also uncovered the fact that both the CTTTCs and the K-6 teachers' classrooms are not adequately equipped with computers and the Internet to train their students effectively. This study will hopefully contribute to the redistribution of funds by the LAUSD to CTTTCs and K-6 classrooms. The results of this study have indicated that computers and the Internet are important tools for both the CTTTCs and the K-6 classrooms. CTTTC teachers, K-6 teachers, and K-6 students would all benefit greatly from the Internet and from all that it has to offer.

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APPENDIX A

TRAINING CENTER CLASS INSTRUCTOR QUESTIONNAIRE

Training Center Class Instructor Questionnaire

Date: _____ Name: _____

Phone Number (If clarification of questionnaire responses is necessary): _____

Location of training center?

_____

What is the subject of your training class?

_____

Have you taught this training class before?

Check one: Yes ☐ No ☐ Please explain _____

_____

How many teachers were present in your training class? _____

Did you have any goals and objectives planned for the teachers in your class?

Check one: Yes ☐ No ☐ Please explain. _____

_____

Did you have any goals and objectives planned for your class with regards to what

the teachers will eventually teach to their students in the classroom?

Check one: Yes ☐ No ☐ Please explain. _____

_____

Did you inquire as to whether the teachers understood the material taught to them

in your training class? Check one: Yes ☐ No ☐

Please explain. _____

_____

Did you inquire as to whether the teachers planned on using the information that

was taught to them in the training class to teach their students?

Check one: Yes ☐ No ☐ Please explain. _____

_____

Are you experiencing any budget problems in the area of teacher training?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Are you aware of any technology support problems (i.e., lack of computers, science equipment, etc.) that the teachers may be experiencing in their classrooms?

Check one: Yes ☐   No ☐

Please explain. _____

_____

Can you think of any areas that you can improve that would assist your students in understanding the topics more easily and more effectively?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Did you use any science/technology/computer equipment to help your students learn the material easier?   Check one: Yes ☐   No ☐

Please explain. _____

_____

Do you have the necessary science/technology/computer equipment in your classroom to teach your students effectively?

Check one: Yes ☐   No ☐

Please explain. _____

_____

APPENDIX B

QUESTIONNAIRE FOR EACH K-6 TEACHER TRAINED

IN THE TRAINING CENTERS

Questionnaire for Each K-6 Teacher

Trained in the Training Centers

Date: _____ Name: _____

Phone Number (If clarification of questionnaire responses is necessary): _____

Part I

From which training center did you receive your training?

_____

What was the topic that you learned in your training class?

_____

Prior to attending the training class, were you aware of the subject that you learned

in your training class?   Check one: Yes ☐   No ☐

Please explain. _____

_____

Did you understand the information taught to you in the training class?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Were the objectives, goals, and requirements of the training class course well

defined and specific?   Check one: Yes ☐   No ☐

Please explain. _____

_____

Do you feel that the course attained its objectives?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Do you feel that you will be able to incorporate what you learned in the training course into your lesson plan?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Was the subject matter presented by the training class instructor effectively?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Did the training class instructor exhibit a broad background and knowledge of the subject matter?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Were the materials used in the training class (handouts, films, etc.) useful?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Do you feel that the training class prepared you to train your students in the subject matter effectively?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Do you have any advice for the training centers which may help them improve their teaching methods and effectiveness?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Do you have a method of determining whether your students understand the material that you teach them?   Check one: Yes ☐   No ☐

Please explain. _____

_____

Do you plan on using any science/technology/computer equipment to help your students learn the material easier?   Check one: Yes ☐   No ☐

Please explain. _____

_____

Do you have the necessary science/technology/computer equipment in your classroom to teach the children effectively?   Check one: Yes ☐   No ☐

Please explain. _____

_____

Do the children in your classroom get "hands on" experience with any science/technology/computer equipment? Check one: Yes ☐   No ☐

Please explain. _____

_____

Did the training class meet your expectations?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Would you recommend this class to your fellow teachers?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Do you have any suggestions of how to improve the effectiveness of the training class that you attended?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Should the training class be offered again?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Have you experienced any peer coaching since the completion of your training class? Check one: Yes ☐   No ☐   Please explain. _____

_____

Do you think that peer coaching would have helped you?

Check one: Yes ☐   No ☐   Please explain. _____

Use a scale from 1 to 10 (10 being most important) to associate your level of importance for each of the following concepts:

Local staff members should always be available for follow-up help, even when outside consultants are used for workshops.   Ranking _____

Please explain. _____

After teachers complete their workshops, they should have easy access to the same tools that they used in their training class.   Ranking _____

Please explain. _____

Teachers should always be the primary trainers of teachers.   Ranking _____

Please explain. _____

The teacher training should always be directly tied to classroom/curriculum/school reform objectives.   Ranking _____

Please explain. _____

Learning to use science/technology/computers is not voluntary, it's required.

Ranking _____

Please explain. _____

Administrators (i.e., principals, superintendents, etc.) should attend the staff development courses along with their teachers.   Ranking _____

Please explain. _____

Time is made available in the teachers' work schedules for staff development.

Ranking _____

Please explain. _____

Part II

Please select two students from your class to be involved in this study.

Did you teach your students about the concept that you learned in your training

class?   Check one: Yes ☐   No ☐

Please explain. _____

_____

If you checked "No" above, please explain why you didn't teach your students the

information that you learned in your training class.

Circle One: Lack of necessary tools (i.e., computers, Internet, science

                equipment, etc.).

                Didn't have time.

                Other (please explain). _____

_____

What was the topic that you taught to your students?

_____

Did your students appear to understand the concept that you taught them?

          Check one: Yes ☐   No ☐

Please explain. _____

_____

Do you feel that the training center prepared you to teach your students effectively

about the topic that you learned in the training class that you attended?

          Check one: Yes ☐   No ☐

Please explain. _____

_____

How could the training center have better prepared you to teach your students about the subject that you taught to your students?

Check one: Yes ☐ No ☐

Please explain. _____

_____

Do you feel that the training class prepared you to train your students in the subject matter effectively? Check one: Yes ☐ No ☐

Please explain. _____

_____

Do you have any advice for the training centers which may help them improve their teaching methods and effectiveness? Check one: Yes ☐ No ☐

Please explain. _____

_____

Did you use any science/technology/computer equipment to help your students learn the material easier? Check one: Yes ☐ No ☐

Please explain. _____

_____

Did the children in your classroom get "hands on" experience with any science/technology/computer equipment? Check one: Yes ☐ No ☐

Please explain. _____

_____

APPENDIX C

QUESTIONNAIRE FOR EACH K-6 STUDENT
TAUGHT BY A CTTTC-TRAINED TEACHER

Questionnaire for Each K-6 Student Taught by a Trained Teacher

Date: _____

What is your teacher's name? _____

What grade are you in? _____

What was the topic that you learned from your teacher?

_____

Did you understand the topic that your teacher taught you in class?

Check one: Yes ☐   No ☐   Please explain. _____

_____

Were you already aware of the topic that your teacher taught you prior to hearing it

from your teacher?   Check one: Yes ☐   No ☐

Please explain. _____

_____

Did you enjoy learning about the topic that your teacher taught you?

Check one: Yes ☐   No ☐

Please explain. _____

_____

Did you use any computer equipment to learn the material?

        Check one: Yes ☐   No ☐

Please explain. _____

_____

Do you think that the information that your teacher taught you would have been

easier to learn if you used a computer or the Internet?

        Check one: Yes ☐   No ☐

Please explain. _____

_____

Do you have the necessary computer equipment in your classroom to learn the topic that your teacher taught you?   Check one: Yes ☐   No ☐

Please explain. _____

_____

Did you get "hands on" experience with any computer equipment?

Check one: Yes ☐   No ☐

Please explain. _____

_____

Do you plan on using the information that you learned in class in the future?

Check one: Yes ☐   No ☐

Please explain. _____

_____

What could your teacher have done differently to more effectively teach you about the topic that you learned in class?

_____

_____

APPENDIX D

COVER LETTER FOR TRAINING CENTER INSTRUCTORS AND K-6 TEACHERS TRAINED BY THE TRAINING CENTERS

Cover Letter for Training Center Instructors and
K-6 Teachers Trained by the Training Centers

Dear participant:

To date, there has been minimal analysis performed on the effectiveness of

technology training centers on K-6 teachers and students. As part of my doctoral

dissertation, I am conducting a study regarding the effectiveness of California

Technology Teacher Training Centers (CTTTCs) on K-6 teachers' and students'

science/technology/computer learning. I would appreciate your participation in this

study. After tabulating the information I will gladly provide the results to all

interested participants. Completing the attached questionnaire should require

approximately 10 - 15 minutes of your time.

CTTTC Instructors: Please complete the attached questionnaire directly after the

completion of your training class. Follow-up questions will be asked if clarification

of questionnaire responses is necessary.

CTTTC-Trained Teachers: Please complete **part one** of the attached

questionnaire directly after completing the training class. Complete **part two** of the

attached questionnaire directly after instructing your students about the topic that

you learned in the training class. Follow-up questions will be asked if clarification

of questionnaire responses is necessary.

CTTTC-Trained Teachers

Please select two students from your classroom that will be involved in this study.

The two students that you have selected to participate in this study should complete

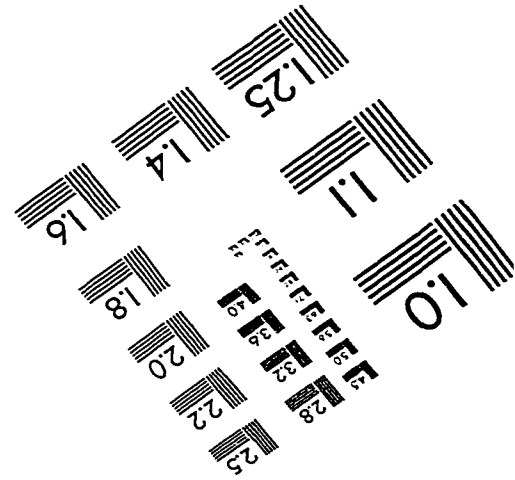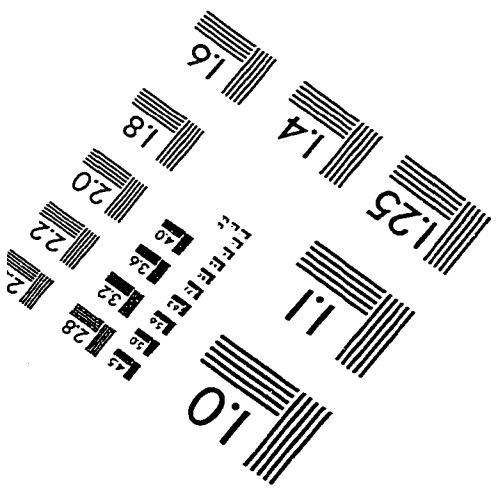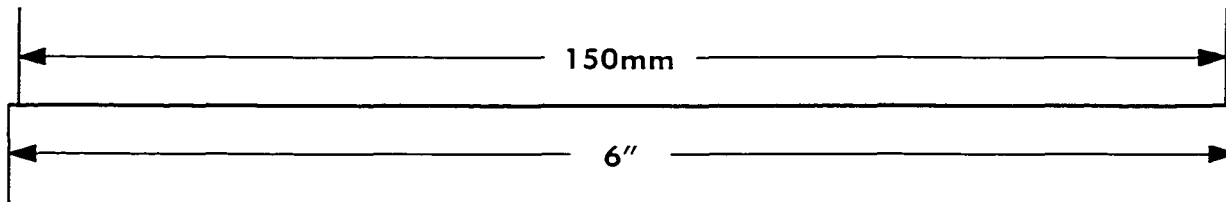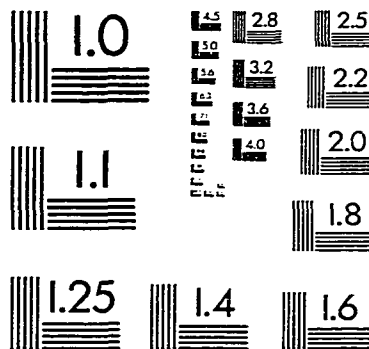their questionnaires at the same time that you complete the second part of yours.
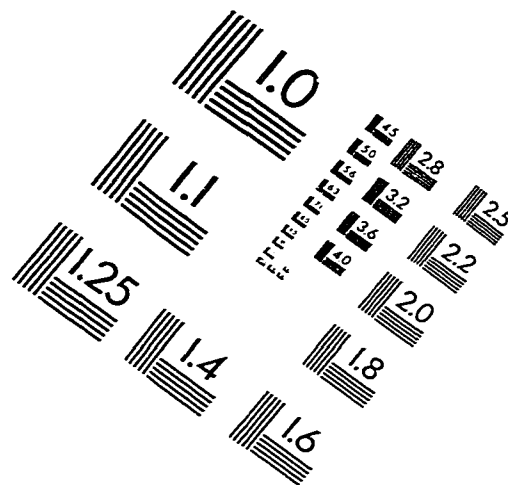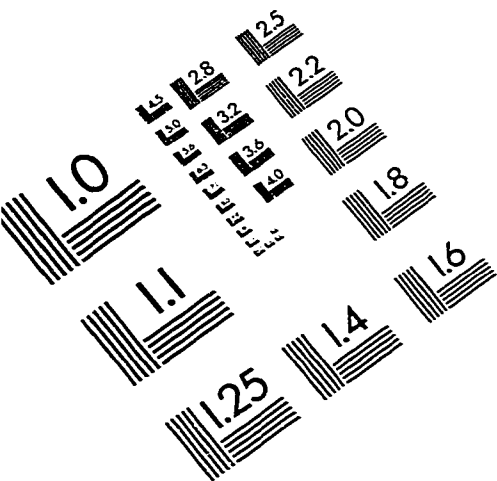
Thank you for participating in this study.

Sincerely,

Steven P. Dierking

Doctoral Candidate, University of Southern California (U.S.C.)

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