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ABSTRACT

Designing new models requires the educators to observe the educational settings in which computer assisted instruction (CAI) was implemented successfully. This paper proposes a CAI model for middle and high schools in Turkey based on the observations and interviews in K-12 schools in Arizona, USA in which computer technologies are implemented successfully. The model consists of three major components, which include: (1) CAI in the one-computer classroom, (2) CAI in the multiple-computer classroom, and (3) CAI in separate computer laboratories. Each component is subdivided into two components: needs of the teacher and needs of the students. The present model provides an initial listing of suggested knowledge bases and skills that appear to be minimums for teachers and students at basic, intermediate, and advanced levels of knowledge and skills. By providing flexibility in the area of teacher and student needs, the model serves as a framework to guide decision making at the national level in Turkey. Appendices include: (A) list of schools in which CAI applications were observed; (B) observation form; (C) list of the interviewees; (D) interview questions answered by directors of academic services information systems & technology offices in the school districts; (E) interview questions answered by the school principals and/or computer coordinators; (F) interview questions answered by teachers and/or media specialists; (G) a sample of observation record; and (H) samples of structured interviews. (AEF)

ANADOLU ÜNİVERSİTESİ

EXPANDING THE EFFECTIVE USE OF COMPUTERS IN MIDDLE AND HIGH SCHOOLS IN TURKEY

ŞEFİK YAŞAR

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Assoc.Prof.Dr. Şefik YAŞAR

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Preface

Computers have now become an everyday part of our lives. Much has been written about the use of computers as a teaching tool in classrooms and as a productivity tool in business and industry. Educators have abandoned the debate over whether computers should be used in the classroom and have turned their focus to the question of how computers can be used effectively in educational settings. This question led the educators to design and develop new teaching models or new teaching applications regarding computer education and computer-assisted instruction (CAI).

Designing new models requires the educators to observe the educational settings in which CAI was implemented successfully. Focusing on this thought, the researcher aimed to propose a CAI model for middle and high schools in Turkey based on the observations and interviews in K-12 schools in Arizona, USA in which computer technologies are implemented successfully.

While preparing the proposed model, the researcher cooperated with his American colleagues at Arizona State University (ASU). He shared the name of the model with Dr. Robert J. Stahl because of his intensive contribution. The model consists of three major components that are associated with existing or likely arrangements of computers in school settings. These components are (1) CAI in the one-computer

classroom, (2) CAI in the multiple-computer classroom, and (3) CAI in separate computer laboratories. These three components could extend to any classroom or school situation at any grade level in any country or district. In this sense, the model has universal applications within and outside of Turkey. The researcher thinks that the proposed model is needed and can be used to guide decisions in middle and high schools in Turkey.

A number of institutions and people contributed in this research.

First of all, the researcher is grateful to the Turkish Higher Education Council, National Education Development Project Coordination Unit and Anadolu University, Faculty of Education in which he is currently faculty member for being provided an opportunity to conduct this research in USA as a part of his post doctoral studies. The researcher is also thankful to the managers of the school districts, school principals, computer coordinators and teachers in K-12 schools in Arizona for letting him observe CAI applications and to conduct interviews.

The researcher would particularly thank to his mentor Dr. Robert J. Stahl for his support and understanding. He would also thank to his former mentor Dr. Sheryl Santos, for her help in preparing the research instruments and contacting K-12 schools. Additional thanks go to Dr. Herbert Cohen and Mark Berkshire.

His special thanks would go to Dr. Marina Stock McIsaac for her support regarding the study. Whenever the researcher encountered with a difficulty regarding the research or anything else in Arizona, he

always got her support. She also allowed the researcher to audit her graduate courses and to make use of her personal library.

The researcher is also grateful to Prof.Dr. Akar Öcal, President of Anadolu University, Prof.Dr. Semih Büker and Prof.Dr. Şan Öz-Alp, Vice Presidents, and Prof.Dr. Ahmet Konrot, Dean of Faculty of Education, for their contributions in publishing this research as a book.

His deepest thanks would go to his wife, Mesude and two sons, Ferhat and Serhat who stayed in Turkey and encouraged him greatly to continue his research.

Eskişehir, 1997 Dr. Şefik Yaşar

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INTRODUCTION

Problem Statement

Computers have now become an everyday part of our lives. Whether or not we touch a computer, it is almost impossible to escape their daily influence on us; from speedy information transmittal, printouts, and receipts, to control of lights and temperature of our workplaces (Deaton, 1991, p. 1). The evidence is overwhelming to indicate that computers are making a major impact upon the societies.

According to Dalton (1989), few innovations have impacted society as greatly as computing technologies (in Barker, 1994, p. 10). Computer literacy is no longer an option in today's job market. The roles of computers in the workplace have expanded in recent years. Skillful use of the computer will be a critical factor in achieving success in many fields (Furst-Bowe, Boger, Franklin, McIntyre, Polansky & Schlough, 1995-96). If educational institutions are to prepare students for employment, and employers are looking for employees who are able to use computers to access information, integrating computers into conventional noncomputer classrooms is essential for the success of students and future employees (Soine, 1996).

On the other hand, the increase of computer usage in all societies gives the impression that life will be different and more complicated in the future than it is today (Yaşar, 1992, p. 2). In order for people to function in the new life style of the future, they should have information about computers, computer programs and master computer skills. In other words, they should be trained in computer skills in order to be computer literate. In order for people to be trained in computer skills, schools should have computer courses in their curriculum (Demirel, 1993, pp. 60-63).

Turkey, whose people need these skills, has been concerned with using computers in education to parallel the developments in the western countries. These concerns have led to the development of the Turkish Ministry Of Education's Computer-Assisted Instruction (CAI) Project in 1984. The main components of the project were:

- Preparing and integrating curricula,
- Designing and developing appropriate software,
- Training of teachers,
- Providing necessary hardware
- Doing research and development studies according to short-term, mid-term and long-term plans (Hızal, 1989, p. 82; Yedekçioğlu, 1996).

Even though official and private institutions worked intensively on the issues associated with using computers in education, unfortunately the Project's plans were not put into widescale practice. All the goals of the Project have not been reached. For a number of reasons, the Ministry of Education (MOE) modified the implementation phase of this Project and its support for this Project' planned use for this technology.

At present, no official agency has yet determined whether priority should be focused on computer literacy or on CAI related to computer usage in education in Turkey. Alkan (1991) stated that the MOE did not have a clear or comprehensive step-by-step strategy or policy concerning this issue.

A very important issue in computer education and CAI is teacher training. Making use of computers is almost impossible when teachers have insufficient computer knowledge in computer education and CAI. Teachers are the key persons to use computers in educational settings productively and to help integrate computers into the curriculum (MEB, 1991, p. 221). Millions of dollars have been invested in hardware and software which are the other two components of CAI. Teacher training in computer education has been ignored (Finkel, 1990). What needs to be done is to establish a balance among these three components of CAI; hardware, software and teacher training. All these components depend on each other: a weakness in one affects all the others negatively. Eventually this situation causes failure in CAI in public school classroom (Gürol, 1990).

In the 1994-95 teaching period in Turkey, CAI applications occurred in 1,934 middle and high schools with 13,915 computers locally networked (MEB, 1994, pp. 117-118). Even though CAI application were started twelve years ago, computers have not been integrated into the curriculum as desired. Educators in Turkey agree that this situation is the main result of lack of sufficient amount of computer literate teachers, lack of appropriate planning, and lack of adequate hardware and quality software (Yedekçioğlu, 1996).

Principals and teachers play important roles as key personnel in the integration of computers in instructional situations and in the adoption of all other innovations in schools (Larner & Timberlake, 1995, p. 13). Also, the support of parents for the integration of computers is very important. Parental support will increase the likelihood of the successful integration of computers into education. Therefore, one of the first things we must do is to make teachers, parents and curriculum developers more aware of the role that technology actually plays in teaching and learning process (Hasselbring, 1991).

Simply placing technology in the hands of teachers is not enough. In order for computers to be used effectively, teachers must have at the very least minimal expertise in computer education and CAI. The appropriate level of expertise may come from formal inservice or preservice teacher training. However, it is not sufficient that teachers should know and use these technologies for a successful computer education and CAI applications. They should be trained how to use these technologies efficiently and fruitfully in the teaching-learning process. If computers are to be the effective tools for learning, each teacher must be trained how to use computers in his or her classroom. Only when teachers are trained on how to teach using computers appropriately will CAI have the greatest impact on student learning.

In order for middle and high schools to have successful computer education and CAI applications, models to ensure the use of CAI in classrooms must be designed and implemented in educational settings. These models should be designed in light of research findings on using computer technology and software successfully in educational settings in developed countries. This study sought to locate or to construct and

refine a model of CAI that could be used in Turkey. Beside the research literature and interviews with experts at Arizona State University, this study involved and depended on the researcher's observations and interviews conducted in middle and high schools in Arizona, USA.

Purposes

The main purpose of this study is to propose a model to expand the effective use of computers in middle and high schools in Turkey. Observations and interviews conducted in K-12 schools in Arizona, USA, were used to collect relevant data that might be used in locating, constructing and refining this model.

Multiple observations and interviews were conducted to answer the following questions that would be useful in addressing the main purpose:

1. For what purposes are computers used in K-12 schools?
2. How are computers used to teach within several disciplines?
3. What software is used in educational settings and why?
4. What types of problems are encountered in CAI settings?
5. What types of activities are being done in order to integrate computers into instruction?
6. What are the best ways to train teachers in computer skills?

Assumptions of the Study

This study was based on the following assumptions:

1. The schools in which computer education and CAI applications were observed are known as the best samples which use computer technologies efficiently and productively among the K-12 schools in Arizona, USA.

2. The data collected through the interviews related to computer education and CAI in the school districts reflect interviewees' personal opinions on the subject.

3. The interviews and observations conducted by the researcher in the K-12 schools in Arizona, USA are sufficient to provide insight into and suggest for a model for middle and high schools in Turkey.

Limitations of the Study

This study was limited to the data provided in and from (a) the research and educational literature, (b) 26 interviews of personnel at five middle schools, one junior high school and three high schools in five different school districts (see Appendix B), and (c) observations conducted at eight schools of four school districts during the spring semester of 1996 (see Appendix A).

Definitions of the Terms

Computer Assisted Instruction (CAI): The use of computers to interact with students in the instructional process. Four of the modes of CAI are drill and practice, tutorials, simulations, and instructional games.

Computer Coordinator: A person who is formally responsible for the provision of computer instruction, resource coordination, and equipment management in a computer laboratory setting (Evans-Andris, 1995).

Computer Literacy: General understanding of computers; an area of study that may or may not be formalized as a curriculum but that

typically promotes a general ability to use computers, to understand their social impact, and to know the ways in which they are used by others (Geisert & Futrell, 1995, p. 312).

Computer Literate: The state of having sufficient computer proficiency and knowledge to meet some expected standard.

Hardware: The physical equipment in a computer system.

Internet: A public computer Network that links smaller Networks together so that users can communicate (Cotton, 1996, p.6).

Multimedia: Term connoting the capability of producing text, color pictures, sound, and motion video, perhaps in combination.

Software: Computer programs that make a computer work and let a user do work on a computer.

Chapter Two

REVIEW OF LITERATURE

Technology in the educational environment is not a new concept. Overhead projectors, motion picture projectors, and video recorders are technological tools; each has been widely adopted as an aid to teaching. However, no machine has as many applications in the educational setting as the computer. Because of its power and outstanding software support, it has the potential of becoming the most important instructional tool in the classroom (Pitsch & Murphy, 1992). Educators are increasingly seeing computers as a powerful tool for improving the productivity of teachers and students, one capable of creating a revolution in teaching and learning process (Becker, 1991; Miller & Olson, 1994).

Reasons for Computer Use in Education

Becker (1985) surveyed teachers who reported that their students had increased enthusiasm for schooling, did more independent work, and helped each other (at the computer station) because of computer use. Therefore, positive attitudes and independence stood out as reasons to continue computer use (in Deaton, 1990, pp. 5-6).

On the other hand, the availability of reasonably-priced computers and the increasing demands on improving the quality of education have also contributed to the utilization of the new technology in instruction (Shenouda & Wolve, 1995-96).

In 1988, the working group of the International Federation for Information Processing (IFIP) enumerated five reasons why computer should be used in education:

- to individualize instruction
- to contribute to learning mastery
- to make higher quality material available more widely
- to emphasize analysis and logical thinking, a major weakness of many learners
- to stimulate educational reform (Dordick & Wagne, 1993, pp. 111-112).

Additional reasons were given by Hickey (1993), as:

- to help students learn through several senses
- to enable study of a wide range of topics
- to permit students to learn at their own pace
- to help students "remember" responses
- to give instant feedback
- to reinforce learning
- to provide practice and enrichment
- to make drill more meaningful
- to provide continuous encouragement.

Much has been written about the use of computers as a teaching tool in classrooms and as a productivity tool in business and industry. Educators have abandoned the debate over whether computers should

be used in the classroom and have turned their focus to the question of how computers can be used effectively in educational settings (Lloyd & Gressard, 1984).

Methods of Computer Use

According to Lockard (1992), computers can be used as a tutor, a tool or a tutee in education.

Using the computer as a tutor

As a tutor, a computer can be used as an active part of the learning process. With appropriate software the computer can be the deliverer of instruction, the patient drillmaster and the guide through a simulated world (Lockard, 1992, p.4). In tutor applications, the computer is programmed by educators and technicians. Generally the computer presents some information or subject matter, the student responds, the computer evaluates the response and presents additional or new information, and the cycle repeats itself (Picciano, 1994, pp. 89-92). Tutor applications are illustrated in Figure 1.

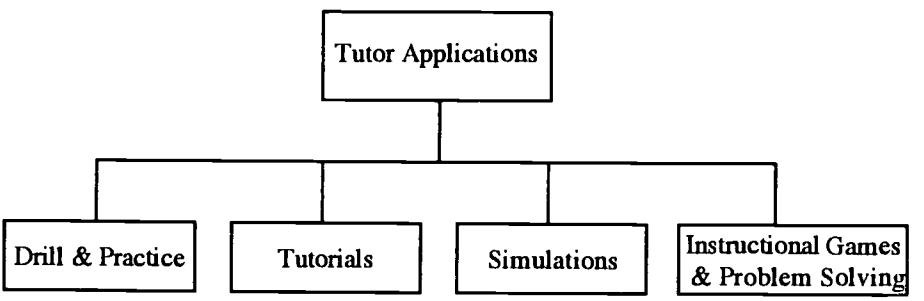

Figure 1: Tutor Application

Drill and practice application does exactly what its name implies: it offers students unlimited opportunities to practice concepts and skills

that they have already learned through other, usually more traditional methods such as lectures and class discussions. The benefits of this are obvious -students reinforce their knowledge. Drill and practice application also helps students memorize information. In computer drill and practice, the usual tasks of students on the computer are repetitive and follow a pattern.

A frequent application of drill and practice software is in the teaching of mathematics. Being essentially a mathematical tool, the computer can present the problems that students must solve based on their knowledge of mathematical facts. It is relatively easy to reinforce multiplication tables, for example, with drill and practice software programs (Bitter, 1989, p. 256; Geisert & Futrell, 1995, p. 138).

Tutorial software, as its name implies, casts the computer in the role of tutor. The computer presents new concepts and skills through text, illustrations descriptions, questions and problems. In many cases, tutorial software comes with pretest, done either on paper or on the computer, to determine the point at which students should start in the program. An advanced student might skip over introductory lessons while a less experienced student starts with the first lesson and proceeds through all that follow (Bitter, 1989, pp. 253-254).

Tutorials are the ideal software programs which enable students to learn the content step-by-step fashion -such as tracing how a bill becomes a law (Dyrli & Kinnaman, 1994). These programs can be functional, particularly, for the students who are temporarily homebound from a class for several reasons. The computer can serve as a one-on-one tutor to teach students the skills that will keep them up with the class (Geisert & Futrell, 1995, p. 142).

Simulations are used in the classroom to present situations that are impossible, dangerous, or too expensive for students to experience in reality. A simulation software allows students to apply the abstract concepts that they have learned to specific situations they might have never had the chance to experience otherwise. In a simulation, the computer does not just present predetermined situations. The strength of a simulation is that the computer responds directly and immediately to student input; that is, the computer's responses depend on the specific choices the student makes.

Numerous teachers have found computer simulations extremely helpful in making their subject matter came alive. For instance, for biology teachers who would like to get across in the classroom the multiplicity of factors involved in the life and death of a pond, nothing beats an instructional simulation designed for this purpose (Geisert & Futrell, 1995, p. 95). In the simulation software program "Oh, Deer," biology students can, for example, practice the managing population of a deer herd in a residential area. Using this simulation software program that requires a higher level of thinking skills, they can play such roles as home owners, farmers, hunters and "deer lovers" (Baird, 1996).

Instructional games are typically designed to be highly motivational and to engage a learner in purposeful activities to accomplish goals, prizes or a winning score. They simulate whole systems, not parts, forcing players to organize and integrate many skills. Students will learn from whole system by their individual action being the student's game moves. For instance, the computer game "Sim City 2000" behaves like a cooperative, goal-attainment-based game. This game includes elements of architecture, urban planning, sociology, economics,

political science, environmental science, mathematics, demographics, history, management, computers, etc. This simulation approximates "real world" conditions and phenomena associated with designing and building a city. It demonstrates the potentially successful or disastrous consequences of complex decision making (Betz, 1995-96).

Problem-solving software is closely related to simulation software in that it requires the student strategy and input. Indeed, it is often rather difficult to distinguish between simulation and problem-solving software. Problem-solving programs are generally intended for use by teachers to (a) provide creative problem-solving opportunities and (b) encourage development of higher order thinking skills. For the most part, problem-solving software does not teach new concepts, rather it offers a means whereby students can apply, test and refine concepts already mastered.

Using the computer as a tool

As a tool, a computer offers the potential of serving as many other tools that extends human potential capacity, all in a single device. Students need to learn to use computers as writing tools and data-storage and -retrieval devices. They need to learn to use telecommunication hardware and software to gain remote access to a world of information already potentially at their fingertips (Lockard, 1992, p. 4). While originally designed for purposes other than teaching and learning, tool software packages are being used effectively in enhancing the instructional process. The popularity of tool software is primarily due to the fact that it is the easiest of all the various instructional software types to integrate into curriculum. Teachers can use tool software without making major changes to the established

curriculum (Picciano, 1992, p. 93). Tool applications, comprising the most frequent uses of computers in classrooms include (1) word processing, (2) spreadsheet and (3) data base software. These applications are illustrated in Figure 2.

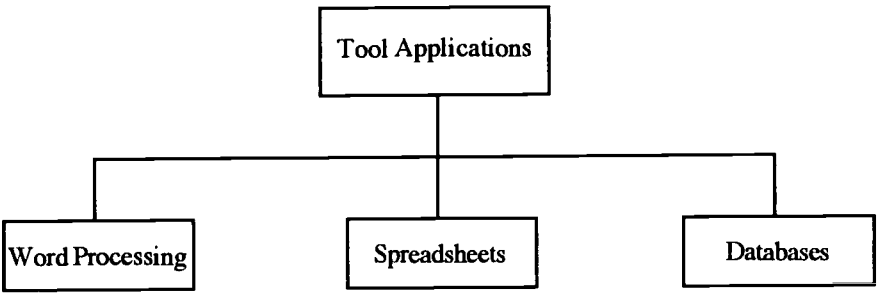

Figure 2: Tool Applications

A word processing program turns the computer's screen into an electronic sheet of paper. The "blank page" shown on the screen accepts the characters you type, automatically making appropriate length lines and the moving the "paper" along as you type. If you wish to correct a typing error or change any part of the document by adding or deleting words, the word processing makes it a breeze to do so. No matter how simple or complex, a word processing program commonly enables the user to:

- produce text
- edit text
- save text
- retrieve text
- print text

Beyond these core capabilities, a word processing program may incorporate a number of other valuable features. Perhaps the most

fruitful use for a word processing software is the preparation of instructional materials. As a teacher's experience with a lesson or work sheet reveals its imperfections or causes the teacher to wish it slightly altered, a modified version of the item can be produced swiftly (Geisert & Futrell, 1995, pp. 53-55). Studies of computer-using teachers indicate that the most frequent use of computer is as a word processing device and the least frequent use is to assist in integrating effective subject matter instruction (Ely, 1993).

A spreadsheet is an electronic blank page upon which one can manipulate numeric quantities. The empty "worksheet' that appears on the screen at the beginning of a spreadsheet program is nothing more than a set of numbered rows and alphabetized columns. The intersection of each row and column is called a cell, each having a unique name. It is into these cells that a user put information to produce a particular worksheet.

One of the most prominent uses for spreadsheets in education is to teach accounting, both principles and practical applications. Math and science also have a similar need to teach concepts and theories, as well as to manipulate vast amounts of numerical and statistical information. Additionally, math teachers find the spreadsheets helpful in teaching students to write and use mathematical formulas. Teachers of social studies can list times and events and sort them on the basis of a feature, such as geographical areas (Bitter, 1989, p. 134; Geisert & Futrell, 1995, pp. 59-61).

Database software programs are designed to solve the problem of storing, organizing, accessing, relating, and changing information.

They are "information processors" helpful for managing all sorts of data. The simpler forms of database programs act as file managers, which catalog information. In their more sophisticated versions, the computer software program becomes a means for answering questions where the answers are based on the analysis of extensive banks of data (Geisert & Futrell, 1995, p. 61).

In computer classes and many other disciplines, databases enable students to spend hours in routine, repetitious data entry tasks. That time may be better used to teach the concepts and practical applications of the particular subject. In the case of quantitative subjects, such as math and science, much basic information can be contained in databases, in this way eliminating human error in transferring it to specific problems to be worked on (Bitter, 1989, pp. 168). Database and spreadsheet programs are used in conjunction with the word processor to show records of information and mathematical operations can be turned into professional documents with the touch of a button.

Using the computer as a tutee

The computer as tutee refers to the creation of software - programs that instruct and guide the computer to carry out some desired task. In a sense, this is the reverse of the tutor role. Now it is the user who instructs the computer, "teaching" the machine to do something new. In fact, this tutee role supports and enables the other roles. Without software, the computer is a lifeless mass of electronics, capable of little more than holding papers in place on one's desk or table (Lockard, 1992, p. 5).

Barriers Limiting the Successful Use of Computers in Education

There are problems associated with classroom computer use. Hasselbring (1991) claimed three major barriers have limited the successful use of computers in education: (1) the installed number of computers is inadequate; (2) good educational software is lacking; and (3) teachers have little or no computer education or training. Computers fail in the classroom because of (1) hardware issues, (2) software limitations, and (3) teacher attitudes and lack of skills to implement instructional computing (Stevens, 1984; Gray, 1996).

According to Madinach and Cline (1994, p. 184) and Wang and Chan (1995), too many projects fail because inadequate training is provided in the effective use of the hardware and software. A common error in such projects is to invest most of the available resources in equipment and virtually ignore the need to allow teachers to become comfortable and competent with hardware, software and the pedagogy implicit in the innovation.

Three major components such as hardware, software and teacher play a key role in classroom computer use. All of these components depend on each other, and a weakness in one affects all the others. For instance, excellent hardware with poor software will not result in a successful application, nor will excellent hardware and software assure success without staff who know how to use them properly (Picciano, 1994, p. 10). Leaders in computer education claim that if teachers possessed and were able to share their knowledge and provide effective computer experiences, academic skills and instruction would be enhanced (Barker, 1994, p. 11).

Chapter Three

METHODOLOGY

In this study, three types of data were gathered in order to answer the research questions. These data were categorized as (1) Theoretical information regarding computer education and CAI, (2) Observations regarding computer education and CAI, and (3) Interviews regarding computer education and CAI.

Data Gathering Techniques

Theoretical Data Regarding Computer Education and CAI

In order to obtain theoretical data, the researcher studied books, articles and other printed materials that were published in English and Turkish. He gathered other material for his research from conference notes, opinions of scholars in the field, and off the Internet.

Observations Regarding Computer Education and CAI

The observations regarding computer education and CAI were conducted at eight schools (5 Middle Schools, 1 Junior High School, and 2 High Schools) in the cities of Gilbert, Scottsdale and Tempe, Arizona in the USA (see Appendix A). The opinions of the scholars at Arizona State University and the recommendations of the technology

directors in the school districts helped the researcher make his decisions in the selection of these schools as the educational settings in which CAI applications were observed.

• Schools in Which CAI Applications Were Observed (Settings)

Two of the middle schools in which CAI application were observed were located in Kyrene School District in Tempe. The rest of the middle schools in which CAI application were observed were in the Scottsdale School District, in Scottsdale. These schools had K-6 and K-8 grades. The student populations of these schools varied from 600-1,100. The computers in the schools in both districts were distributed to all the classrooms, every classroom has at least one computer. The majority of the computers were Macintosh, the rest of them were IBM compatible. In addition, the middle schools in Scottsdale Unified School District had mini computer laboratories which served specific purposes. The ratio of computer-to-student in the these schools varied from 1:4 to 1:6. Students enrolled in the middle schools in Kyrene district had Internet access.

The other educational setting in which CAI applications were observed was a junior high school in Gilbert city. This junior high school had 7th and 8th grades. Student population of the school was 996. This school had four computer laboratories each of which served specific purposes. In addition, each classroom had at least one computer. Computer-to-student ratio in the school was 1:12.

The two high schools in which CAI applications were observed were in Tempe. Student populations of these schools were 1,300 and 2,200. Both schools had K-9 and K-12 grades. Computer-to-student

ratios in these schools were 1:6 and 1:7. Computers were generally located in the laboratories of these schools. Each school had seven laboratories each of which served specific purposes. Forty percent of the computers in the schools were Macintosh and 60 % were IBM compatible. Each school had a computer coordinator on its campus. In addition, personnel in the schools' infrastructure worked to obtain Internet access on both school campuses.

• Participant Observations

The observation form was prepared before conducting the observations in the educational settings. The observation form sought demographic, equipment, environment, and usage data (see Appendix B). Then, either the principals or the computer coordinators introduced the researcher to the teachers who used computers intensively and effectively either in the classrooms or the laboratory settings. The researcher and the teachers made joint schedules in order for the researcher as a participant observer to observe CAI applications in their classes. The researcher observed the: (1) "Social Studies" classes in the eighth grade of two middle schools; (2) "Industrial Technology" class in the seventh grade of one middle school; (3) "Computer Applications" class in the sixth grade of two middle schools; (4) two classes called "Keyboarding," one was in the seventh grade of junior high school and one was in the eleventh grade of high school; and (5) "Mathematics" class in the ninth grade of one high school.

In a participant-observation study, the researcher actually participates in the situation or setting he is observing. Participant observation can be overt in that the researcher is easily identified and the subjects know that they are being observed, or covert, in which case the

researcher disguises his or her identity and acts just like any of the other participants (Fraenkel & Wallen, 1996, p. 451-452). In this study, participant observation was overt; that is, he was known by the teachers and students because he had to get permission from teachers in order to be allowed to observe their classes at least a week before.

While observing the activities of the students in the computer-assisted instructional settings, the researcher talked to the students individually from time to time and asked them whether they encountered any problems with their work. The teachers sometimes took part in these conversations. They made the situations clear when the students had difficulties in giving explanations. The researcher was particularly interested in the teaching techniques the teachers implemented in order to make use of computers fruitfully in the computerized educational settings. The students who learned that the researcher came from an overseas country asked some questions concerning his country, Turkey. They also asked him to compare the educational system of Turkey with their own. During the classes a very natural, comfortable and warm atmosphere was created. The students, particularly in the "Social Studies" classes, asked the researcher to verify the information they obtained through the Internet regarding Turkey. After the first hours of the observations, the researcher felt as if he was a member of the classroom. Everybody in the classroom including the teacher learned new facts and displayed great enthusiasm.

The observations conducted during the classes "Keyboarding" and "Mathematics" were more quiet than the others. In these settings, students concentrated on instruction and applied themselves to solve math problems.

The researcher spent 32 hours observing CAI applications in these schools.

Structured Interviews Regarding Computer Education and CAI

The structured interviews, conducted with 26 interviewees (see Appendix C), were grouped in three categories: (1) The interviews conducted in the technology offices of the school districts, (2) The interviews conducted with the school principal and/or computer coordinators, and (3) The interviews conducted with teachers.

Before conducting the interviews, interview forms were prepared for each group of interviewees (see Appendices D, E and F).

- The interviews conducted in the technology offices of the school districts

These interviews were conducted with five people who work as either technology director or assistant director in the school districts. The questions (see Appendix D) addressed to these people referred to the computer facilities of the schools in that district, the use of computers in the educational settings, and teacher training in order to gain computer skills. In other words, these interviews aimed to get the general policy of the districts regarding to computer education and CAI applications of the districts. These interviews helped the researcher verify the information obtained from computer coordinators and teachers. If a conflict happened between the answers of the interviewees, the data obtained by observation forms were accepted as true.

The interviews were conducted in the technology offices of the districts. All the interviews were audiotaped, each of which lasted approximately fifty minutes. After each interview, the researcher was taken to some schools and provided with an opportunity to see the computer laboratories of those schools. In addition, technology plans of some schools were given to the researcher as well as some documents which includes technical data concerning the schools and district.

- The interviews conducted with the school principal and/or computer coordinators

Ten respondents from nine different schools in five districts participated in these structured interviews. The interviewees worked as either a school principal and/or computer coordinator on the campus. The questions (see Appendix E) addressed to these people referred to the computer facilities of the schools in which they worked, the use of computers in the educational settings, what types of problems they encountered in CAI applications and the methods of teacher training in order to gain computer skills. The audiotaped interviews were conducted either in a principal's office or in a computer laboratory. Each interview lasted approximately one hour. After each interview, the researcher was shown and given a briefing about the computer laboratories and multimedia facilities in each particular school. In addition, the researcher was shown sample projects that were created by students on the computer.

- The interviews conducted with the teachers

These interviews were conducted with three different groups of teachers: (1) teachers who utilized computers in their classes intensively, (2) teachers who work in the district office as mentor, and

(3) teachers who were observed. A total of twelve teachers participated in these audiotaped interviews, each of which lasted approximately 40 minutes. Teachers whose classes were observed were interviewed after the observations. The questions (see Appendix F) addressed to the teachers referred to how they used computers in their classes, what types of software they used and why, which teaching techniques they used to teach with computers, and what types of problems they encountered in CAI applications etc.

Interviews were occasionally interrupted by students, intercom announcements, or faculty. Usually, if other teachers inadvertently interrupted an interview they exited quickly and apologetically. Periodically a teacher would join the interview informally after overhearing bits of the conversation. These occasions actually enriched the data because the researcher would discuss and elaborate on each others' experiences and perceptions regarding computers and CAI applications.

While some teachers were answering the interview questions, they used computers to demonstrate to the researcher how they used computers in their classroom. Other teachers showed sample projects which their students created utilizing computers in their classes and explained them in detail while answering the interview questions.

If a conflict happened between the interviews and observations, the researcher discussed the point with the teacher, so he clarified or prevented a misconception.

Analysis of Data

After the observations[1] and interviews[2] were conducted, the collected data were analyzed. First, audiotaped interviews were transcribed by the researcher. Then the questions and responses were noted and combined for the data report. As a third step, the interviewees' responses to each question were evaluated as a whole in order to reach the result for each question.

1 A sample of observation record is provided in Appendix G.

2 Samples of structured interviews are provided in Appendix H.

Chapter Four

FINDINGS AND OVERALL CONCLUSIONS

Findings

For What Purposes Are Computers Used in K-12 Schools?

In the K-12 schools that were visited, the researcher observed that computers were used as a powerful device in providing, organizing and presenting information. For instance, in a "Social Studies" class, the students used computers to obtain information via the Internet, organized the information that they obtained and presented this information to their friends in an effective way. Students were observed independently constructing knowledge in step by step sequence using computers in the individualized instructional settings. The researcher witnessed that computers were used as a device of fast communication as they electronically sent their project assignments to their teacher. The researcher also recorded teachers' behaviors during his observations. Teachers made use of computers in preparing lesson plans, preparing slide shows for presentations, keeping all kinds of records concerning their students, keeping students' grades, and electronically communicating with their colleagues.

The directors of technology who were interviewed stated that computers were used as a powerful tool to obtain the information, organize the information and to present this information in efficiently in K-12 schools in their district. In addition, they confirmed that teachers in their respective districts used these technological devices to communicate electronically with one another.

School principals or computer coordinators who were interviewed said that computers were and will continue to be used to gain students computer literacy and/or master their current computer skills. They emphasized that computers were used to enhance the effectiveness and productivity of teaching in their schools. They also added that teachers used these technological devices in doing their lesson plans, preparing slide shows for presentations, and in electronically communicating with their colleagues.

The teachers that were interviewed and/or observed said that they made use of computers as a powerful tool in their classes to create an effective and fruitful teaching and learning setting. Their comments paralleled the opinions of directors of technology, school principals and computer coordinators. Some teachers mentioned they used computers both as a tool and as a tutor in order to reinforce the subjects that students had already studied. Teachers also said that they used computers in planning their lessons, preparing slide shows for presentations, keeping students' grades, and in communicating electronically either with their colleagues or students.

Data regarding both observations and interviews indicated that computers in these K-12 schools were used as tools and/or tutors. In

other words, computers as inseparable parts of education were utilized in these schools to help students learn better and more easily. Based on the observations and interviews, the researcher concluded that computers in these K-12 schools were used by teachers in doing lesson plans, preparing slide shows for presentations, keeping all kinds of records concerning the students and communication electronically.

How Are Computers Used to Teach Within Several Disciplines?

The researcher observed that computers in these K-12 schools were used as both tool and tutor. Students in settings in which computers were used as tools utilized these technological devices to obtain extensive content related information via the Internet and to organize the information they obtained using a variety of software.

For instance, while the students who worked in groups of two persons in a "Social Studies" class were doing their research projects concerning several countries, they first obtained information such as maps, pictures, text, etc. regarding those countries utilizing the Internet. Then they organized the information using specific software programs. Finally they presented their projects to their classmates on the large screen utilizing computer with overhead. Students in groups of two constantly cooperated with each other in providing and organizing the information. Student groups asked for help from the teacher as well as from other groups as they needed. They made use of their teacher's recommendations in reaching information sources, organizing the information they obtained, and presenting their project data and conclusions. Students in these groups did their research projects based on the principles of cooperative group work. Students also learned their

subject by structuring the knowledge step by step by themselves as suggested by one version of constructivist learning theory (Hooper, 1992). Their teacher was a facilitator who helped them to reach the information sources rather than a monopolized who acted as the sole content provider.

Another class in which computers were used as tools was "Industrial Technology". The thirty-four students were assigned into seventeen peer groups, by taking into account their desires at the beginning of the semester. Each group determined its project and informed the teacher about it. Each week the progress the groups made concerning their projects was written in a detailed plan that was pasted on the wall of the classroom. Each group had (a) to design some part of the project that was supposed to be finished using the computer in that week and (b) to show that design to the teacher. All the groups worked on their respective project as planned. Whenever they encountered a problem, they asked the teacher for help. The teacher went from one computer station to another and tried to answer all the questions addressed to him. In addition the teacher, acting as a troubleshooter, helped students to solve their problems. In this computerized educational setting, the teacher tried to do his best to use cooperative groups successfully.

Students in a "Computer Applications" class were learning word processing, spreadsheets and database software programs in a locally-networked computer laboratory. The teacher employed an individualized instruction method where students learned facts and application skills. The teacher first introduced the word processing software program by projecting it to the large screen using her computer station. Then she

demonstrated how she prepared her resume using that software program and asked the students to create their resumes utilizing it. In this instructional setting, each student tried to create his or her resume using word processing software. The teacher went from one computer station to another and tried to help the students individually in solving their problems. The teacher acted according to the principles of individualized instruction method.

Students in a "Keyboarding" class were learning keyboarding skills using their ten fingers. The keyboards used by the students were blank. Students were placing their fingers on their keyboards according to the teacher's instructions. They did not keep their eyes from the screens of their computers and typed the words that the teacher said. At the end of the class, each student printed out what s/he typed. Thus, they had a feedback concerning their success in "Keyboarding." Computers were used as tools in this class in conjunction with an individualized instruction method was employed.

The students observed in Mathematics class used computers as a tutor. These students had been away from school for several reasons or with had low levels of academic achievement. They were being given remedial teaching in this computerized educational setting. Students were trying to learn their subject content by applying the instructions given by computer, reading explanations and doing the exercises. At the end of the class, each student had to hand in a print out regarding what he or she did that class period. The teacher went from one computer station to another to help students individually. In this individualized instructional setting, the teacher acted as a facilitator to help students to learn better and more easily.

The directors of technology said that computers had become an inseparable part of education in schools in their district. They stated that computers would eventually be used in teaching of all the classes, from mathematics to physical education. In addition, they mentioned that focusing on this thought, they tried to spread computer usage in their districts and provide the Internet access to students in every schools.

The school principals or computer coordinators who were interviewed stated that computers were used as a powerful tool for such reasons as (a) to enhance teaching, (b) to help students to develop their critical thinking skills, and (c) to gain students the research skills. One of the coordinators said that the computer, if it replaced the teacher, would play a "bad teacher" role. School coordinators emphasized the vital functions of computers by mentioning about their use in teaching abstract concepts in Mathematics and in doing dangerous or expensive experiments in science. They added that if they were utilized efficiently, computers could provide positive contributions.

Teachers who were interviewed and/or observed stated that they utilized computers intensively in their classes as an inseparable part of teaching and learning process. Some teachers mentioned that computers would be used in language arts as powerful tools because they provided spell check and grammar check. Other teachers supported the school principals and computer coordinators by saying computers were used in teaching abstract concepts for instance, in mathematics, and in doing costly or dangerous experiments in science. On the other hand, the teachers in the field of fine arts said that they used computers as a tool for the graphic programs. Teachers of social studies stated that these technologies were used in obtaining information via the Internet and in

organizing the information in their classes. Teachers of "Industrial Technology" stated that computers were the most appropriate tools for their classes because they played an important role in helping students to visualize their abstract project designs. In addition, these teachers reported that they implemented both cooperative group methods and used completely one-to-one teaching in their classes based on the computer facilities in their schools.

Data from both observations and interviews revealed that computers were used as a powerful teaching tool and these technologies would be used in both one-to-one teaching and cooperative-group settings in K-12 schools. In conclusion, computers were frequently utilized as tutors in a variety of subject areas.

What Software Is Used in Educational Settings And Why?

The researcher observed that word processing, spreadsheet, and database software programs were made use of in the CAI settings in which computers were used as tools. For instance, in the "Computer Applications" class, the sixth grade students created their resumes using the software "Microsoft Word." This software program enabled the students to produce, edit, save, retrieve and print the text. In the "Social Studies" class, the researcher observed students obtaining information regarding several countries using the Internet program "Netscape," and preparing their presentations using the software program "Power Point." In the "Industrial technology" class, students created the designs of their projects using the software program "Macdraw." In a mathematics class, students used a tutorial software program developed by the Jostens/Wicat Company. In this class, students studied the

subject according to the instructions given by computers. In the "Keyboarding" class, students gained keyboarding skills using the software program "The Diana King Method."[3]

The directors of technology stated that the teachers had enough software programs regarding word processing, spreadsheet, and database in order to meet the needs of students and teachers. They emphasized that the software program "Claris Work" was widely used in schools in their respective districts. They said that when teachers needed new software programs, they would provide these valuable resources to them.

The school principals or computer coordinators stated that they used "Claris Work" and "Microsoft" in their schools. They added that the programs "Claris Work" and "Microsoft Word" were preferred particularly in language art classes while the program "Microsoft Excel" was preferred in business classes for spreadsheets.

Each teacher mentioned the particular software programs that s/he used in CAI settings. For instance, one of the teachers explained the use of the software program "LinkWay" in "Social Studies" by referring to Richman (1995): Using "LinkWay," students produce a variety of multimedia projects, both individually and in groups. A group of students, for instance, recently took a trip to Grand Canyon and

[3] "Diana King Method" is very teacher intensive. The method is based on students learning a rhyme. The rhyme mentions, in order, each letter of the alphabet and tells with which finger the letter should be struck. In every lesson at least two new letters and correct fingering technique for the letters are introduced, and past letters are reinforced. Following an itial warm-up execises, the teacher introduces the new letters for the day (Nichols, 1995).

photographed it for a "LinkWay" presentation. They digitized it and stored images, wrote and recorded their narration, imported music, then presented the program to their classmates. A teacher of English that was interviewed mentioned the software programs, "The Sound of English"[4] developed by Interactive Inc. and "Skills Bank II"[5] produced by Skills Bank Corporation were used fruitfully in English classes. Some teachers stated that they used the software program "Power Point" in preparing their slide shows for presentations.

Findings from both observations and interviews revealed the software programs that were used in CAI settings differed in terms of specific features and needs of the individual subject matter disciplines and the objectives of teachers. The researcher found that some teachers preferred tool programs such as word processing and spread sheets while others preferred tutorial software programs.

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4 "The sound of English" shows students how to produce all the sounds of the English language by providing animated characters who demonstrate the correct lip movements. Through a microphone built into the computer, students can record their own pronunciation and then replay both the system's and the studens' voices for comparison. Match and concentration games offer less formal but equally effective aural practice in English (Shenouda & Wolve, 1995-96).

5 "Skills Bank II", provides sets of lessons at various skills levels in four major areas: Reading, Writing, Language, and Study Skills. Each area is further divided into smaller components. Reading, for example, is divided into sections on comprehension, vocabulary and word knowledge. Each component offers between nine and twelve lessons that provide rules with examples and ten to fifteen questions with multiple-choice answers. At the end of the question-answer component, the system shows the students' scores and the time spent in answering the questions. The system tracks the students' progress and allows them the flexibility to move back and forth amng lessons. In addition, each component has a pre-test and post-test that the instructor can use to measure the students' progress after using the program (Shenouda & Wolve, 1995-96).

What Types of Problems Are Encountered in CAI Settings?

The researcher witnessed that the problems occurring in CAI settings were associated with hardware and software. The problems regarding the hardware occurred in a numerous ways. For instance, either the computer systems (servers) were down or the printers did not work appropriately in the computer laboratories. On one occasion, the researcher observed the newly-bought software program did not work in the computer laboratory. A technician was called from the district office to fix it. In 20 minutes' time the technician came to the campus and activated that software program. This problem occurred because the teacher and the computer coordinator were not familiar with this particular software program. In another situation, the researcher noticed that the teacher had a difficulty in tutoring students individually because many students asked for help from the teacher at the same time. In this situation, the teacher felt weak in carrying out her role in this CAI setting.

The directors of technology stated that the major problem that they encountered in their districts regarding CAI settings was the technology (hardware or software) by itself because it was diminishing quickly. They also added that they had to update the old technology with the new one.

The school principals and/or computer coordinators stated that they had problems associated with hardware and software in their schools --a point also made by the directors of technology. They explained that the problems regarding software occurred because the software was either technically faulty, was being used improperly, or the teacher was not

adequately familiar with the use of that particular software.

The teachers stated that the problems occurring in CAI settings were related to both hardware and software. One teacher who wanted to individualize instruction in the classroom said that a single teacher was not enough to help students in CAI setting. Another teacher mentioned that a major problem in CAI settings concerned "security issues" --such as keeping students out of each other's files.

The findings from both observations and interviews revealed the problems occurring in CAI these settings were due to both the hardware and the software. These problems probably occurred because (a) the computer systems were down, (b) the computer equipment was not adequate to handle the data processing needs of the software or the user, (c) the software was technically faulty, (d) the software was used improperly, or (e) teachers were not adequately familiar with the use of the specific software.

What Types of Activities Are Being Done in Order to Integrate Computers Into Instruction?

The researcher observed that each district had a unique technology project or plan in order to integrate computers into instructional settings. For instance, the educators who carried the idea of "Teachers are key persons in integrating computers into instruction" in one of the school district had a project called "Lap top Computers for Teachers." According to this project, all the teachers in the district would be equipped with lap top computers. The funding came from tax payers. Fifty teachers at a time in the school district received lap top computers each semester. During the summer, these teachers were provided

inservice training to gain computer skills both on school campuses and in the district office.

Educators who thought that families played an important role in integrating computers into education as well as teachers in another school district organized courses for families to gain computer skills. Teachers in one district were allowed to take their computers home over the weekend and during national holidays.

Another school district had a different technology plan to provide access to computer technology beyond the school walls and beyond school hours. They made this possible by providing access to their Homepage to those students who had computers and modems at home. Students who did not have access to home computers were accommodated in a number of ways. School computer and information centers were opened beyond normal school hours for students and family use.

Some of the directors of technology said that teachers were the only people directly responsible for integrating computers into instructional settings. The rest of the interviewees emphasized the significance of the family in integrating computers into education and that teachers could help.

The school principals and/or computer coordinators said that the integration of computers into instruction would be possible only when computers became a regular part of daily life. Their other ideas paralleled the ideas of the directors of technology.

On the other hand, the teachers that stated that if they were the key

people in the integration of computers into education they themselves had to be trained in computer skills. One of the teachers mentioned the significance of teachers in terms of educational settings by exaggerating the functions of teachers in instruction saying "Instruction in the classroom starts with the teacher and ends with him or her." He added that "if the successful integration of computers into instruction was expected to be achieved, then these technologies and their usage must be taught to the teachers."

Data from both observations and interviews revealed these teachers saw themselves as the key persons responsible for integrating computers into instruction. They also were unanimous in their insistence that they needed to be trained in the relevant computer skills and the use of computers in educational settings. The research also revealed families had to be trained in computer skills because they played a significant role in the integration of computers into education. These findings by this researcher were very consistent with the findings of other studies reported in the literature (Hasselbring, 1991; Picciano, 1994).

What Are The Best Ways to Train Teachers in Computer Skills?

The researcher found out that the main concern in these K-12 schools was to assist teachers gain computer skills to ensure they use these skills along with the technological devices to be more effective as teachers. Focusing on these concerns, the authorities in these K-12 schools organized inservice training programs on campus level and/or district level either after school hours or during summer in order for teachers to gain computers skills. Computer coordinators, computer

specialists, and computer teachers in these K-12 schools were employed to give inservice training for teachers because these professionals believed that teachers were the best people to train their colleagues. Teachers were put in CAI settings so that each teacher could use independently a computer station. In order for them to master the targeted computer skills, the to-be-trained teachers were given one-to-one training.

In order for the teachers to learn how to use computers to teach with, a "Mentorship Program" was implemented in the schools. This program was aimed at helping teachers master the use of computers to teach with in these K-12 schools. Thus, master teachers acted as good models and teachers for the teachers.

The directors of technology stated that they periodically conducted inservice training programs for the teachers in their districts. They believed that simply placing powerful technology in the hands of teachers was not enough and these teachers needed training on how to use computers. They reported that the inservice training programs designed to help teachers gain computer skills to the teachers were not mandatory. They said that in every occasion they encouraged teachers to gain computer skills through these inservice programs.

The school principals and/or computer coordinators stated that they themselves periodically conducted inservice programs in order for the teachers to gain computers skills on their school campuses. They mentioned that they trained teachers using a one-to-one teaching method. They stated that if their help was needed, they did their best to help their colleagues either in gaining computer skills or in solving the

particular problems occurring in these CAI settings. They added that they acted as good models for the teachers who wanted to use computers in their classes.

These teachers claimed that computer skills could and would be gained by equipping their classrooms with computers and providing them access to these devices in the school as well as outside their school. They stated that they gained computer skills by participating in inservice training programs that were conducted either on campus or in the district office as well as in degree programs provided by the colleges. They said that they were motivated to gain computer skills by such factors as (a) students' use of computers, (b) updating their skill base, (c) use of computers by their colleagues, and (d) wanting to use the technology in their classroom. They said that their main helpers and supporters were the computer coordinators in their respective CAI settings.

Data from both observations and interviews revealed that inservice training programs played a vital role in helping them gain computer skills and using computers in their classrooms. This researcher found that these teachers were trained by their colleagues who acted as a model. These findings were very consistent with the findings of the other studies reported in the literature (Chisholm, 1995-96; Evans-Andris, 1994; Hasselbring, 1991; Wang & Chan, 1995).

The findings of the study can be summarized as follows:

- Computers in these K-12 schools were and will continue to be used as tools and tutors. Computers as inseparable parts of

education were utilized in diverse educational settings and subject matter discipline areas to help students learn better and more easily. These technological devices were used by these K-12 school teachers for many reasons including (a) doing lesson plans, (b) preparing slide shows for presentations, (c) keeping all kinds of records concerning the students, and (d) communicating electronically with colleagues.

- Computers were used as a powerful teaching tool in all educational settings and these technologies were used in these K-12 schools in both one-to-one teaching and cooperative group settings.

- The software programs that were used in these CAI settings differed in terms of the features of the subject matter disciplines and the objectives of teachers. Some teachers preferred to use tool programs such as word processing and spread sheets while others preferred to use tutorial software programs.

- The problems that were encountered in these CAI settings were related to both hardware and software. These problems occurred in educational settings for many reasons, including but not limited to the following: (a) the computer systems were down, (b) the software was technically faulty, (c) the software was used improperly, and (d) teachers were not familiar with the use of a particular software program.

- These teachers were the key persons responsible for integrating computers into instruction. They knew and accepted the fact that

they had to gain computer skills and to use computers in their classrooms. Families were perceived as needing training in computer skills because they played a significant role in the integration of computers into education.

- Inservice training programs for teachers played a vital role in helping these teachers gain needed computer skills and using computers in their classrooms. Teachers had been and were being trained by their colleagues acting as role models of effective computer use. More importantly, these teachers reported they would learn to use computer skills from their colleagues in the same school or district.

Overall Conclusions

The following conclusions were drawn based on the findings of the study:

Computers in K-12 schools in the USA are mostly used as tools to enhance the effectiveness and productivity of teaching and learning. They are used in instruction in both one-to-one teaching and cooperative group settings. Tool programs such as word processing and spread sheets are usually preferred in computerized instructional settings. The problems encountered in the classroom are associated with hardware and software. Teachers are perceived as the key persons for integrating computers into instruction. Inservice training programs play a vital role in helping teachers gain needed computer skills and using computers in the classrooms.

Chapter Five

A MODEL TO GUIDE CAI DECISIONS IN MIDDLE AND HIGH SCHOOLS IN TURKEY: A PROPOSAL

Middle and high schools in Turkey differ substantially in terms of computer facilities. For instance, the schools in the urban areas have more computers than do ones in rural areas. The same things can be stated for private schools. Computers in the schools are used for both administrative and educational purposes in Turkey. However, they are currently located only in administrators' offices and separate laboratories.

The computers in the laboratories are locally networked and generally used to provide students access to gain basic computer skills. In some cases, these computers are used as tutors when the schools have tutorial software programs and/or computer-literate teachers. If schools have no computer-literate teachers, these laboratories are generally being kept idle. In other words, computers in the schools are not now being used as powerful teaching tools.

Need for a Model to Guide Decisions Concerning the Use of Computer Technology in School Settings

The educators in Turkey are no different than those in all nations in their concern for using computer technology in K-12 classrooms. They

must address the issues of obtaining the appropriate equipment and software, making sure these are used effectively and efficiently by teachers and students alike, and making sure that they are actually used rather than are placed in classrooms and rarely used. These concerns are not unlike those that accompanied the introduction of overhead projectors and televisions in classrooms in the 1960s and 1970s which saw this equipment placed in many classrooms across the world but this equipment was often not even used by either teachers or students - even when teachers received training on how these should be and could be used.

Given the research literature, the findings from the observations and interviews from this study, and the suggestions made by advocates of computer technology use in classrooms, there was not a model that provided a blueprint that could be followed to enable educators at all levels to view the complex issues surrounding educational use of computers in a myriad of possible classroom configurations. In addition, there was a need for a model that could provide for a short term and long term perspective of computer use in classrooms and that would enable planners to view how they might go about developing a systematic plan to maximize computer use in classrooms among both teachers and students in light of needed knowledge and skills and available computers per classroom. For instance, planners need to realize that in some classrooms, only one computer may be available for that teacher and his or her students for a short or long period of time. In other schools, multiple computers may be available for a single teacher or an entire computer laboratory may be set up. Because these options are currently available, do exist in various schools in Turkey and in every other nation, and may be realities in the short if not long term future, planners need a model that would help them distinguish among

and target (a) what is available, (b) what is likely and (c) what would be ideal.

The model that will be proposed is needed and can be used to guide decisions in each school building, on the local and national levels, and in teacher training programs and Universities to prepare teachers to use the computer technology that they may have available to them and will have available to them in the near future.

Origins of the Model

The initial components of the model that is proposed here were cooperatively generated by Şefik Yaşar and Robert J. Stahl[6] during interactions with the researcher. The creation of the model followed a series of extensive dialogues concerning the literature review and the results of the observations and interviews by this researcher with local school officials and in classrooms. Given the skeleton of this model, this researcher and Dr. Stahl worked as colleagues and collaboratively to (a) refine the model, (b) elaborate its components and their purposes and (c) suggest an initial list of possible knowledge bases and skills that would be relevant for each of the components or 'phases' of the model. Each component has direct implications for each teacher, classroom, school administrator and teacher training institution as well as for planners in the Ministry of Education in Turkey. While there will be refinements and adjustments for element 'c' in the model, components 'a' and 'b' are likely to remain intact. These two components could, however, be expanded and refined with additional descriptions and purposes as well as examples.

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The Yaşar-Stahl Model

The model consists of three major components that are associated with existing or likely arrangements of computers in school settings. These three are (1) CAI in the one computer classroom, (2) CAI in the multiple computer classroom, and (3) CAI in separate computer laboratories (see Figure 3).

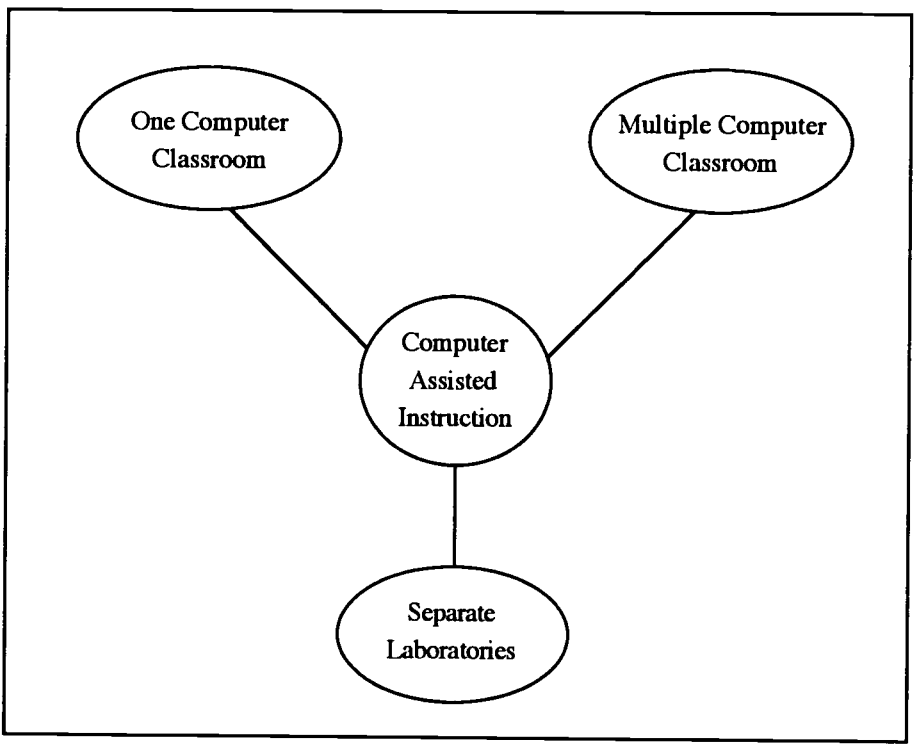

Figure 3: A CAI Model For Middle And High Schools in Turkey

These three components could extend to any classroom or school situation at any grade level in any country or district. In this sense, the model has universal applications within and outside of Turkey.

Each component is subdivided into two components: (a) Needs of the teacher and (b) Needs of students. These two divisions account for those individuals who are responsible to using the one or more computers available to them in their particular educational situation. For instance, if there is only one computer in a classroom, then that computer could be used in a number of different ways by the teacher -- and by one or more students in that classroom with the permission of the teacher. Merely because a classroom has only one computer does not mean that students should be prevented from using it. Quite the contrary, teachers must be taught and then encouraged to find ways to allow students to use the computer even when there is only one computer in that particular classroom.

To address these needs, the present version of the model provides an initial listing of suggested knowledge bases and skills that appear to be minimums for teachers and students at three levels: (a) basic, (b) intermediate, and (c) advanced levels of knowledge and skills. Individual schools, school districts, Ministries of Education, and teacher training institutions may develop their own listing of knowledge bases and skills for each component or may negotiate these among teachers and administrators to meet their unique needs, resources, financial situation, and short- and long-term needs. By providing flexibility in the area of teacher and student needs, the model serves as a framework to guide decision making at the national level in Turkey.

A Brief Outline of the Components, Purposes and Component-Subdivisions of the Model

The three components, the purposes of each component, and the two subdivisions of each component of the Model are described below.

1. CAI in the One-Computer Classroom

Description of this component. - This component refers a to situation where there is only one computer in the classroom. Here, the teacher makes primary use of the computer as a powerful teaching tool to enhance the learning of students. The computer in the one-computer classroom should not be viewed as being used only by the teacher. Students may utilize the computer as individuals, in small groups or in large groups at various times (Ornstein, 1992). The monitor image may be projected to the large screen with an overhead projector in this application. In addition, the sound can be added to the visual images. This component is illustrated in Figure 4.

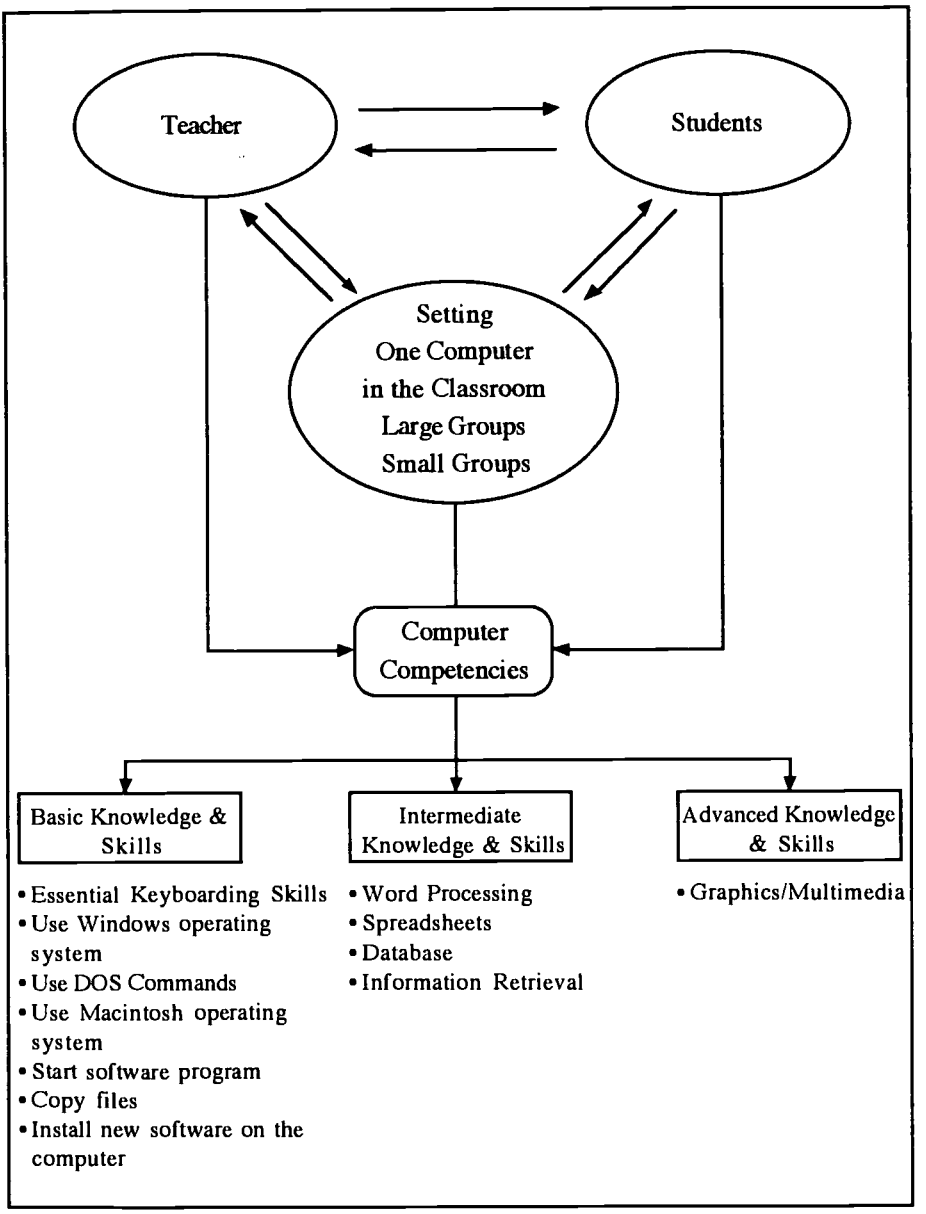

Figure 4: CAI in the one-computer classroom

Purposes of this component. - The main purpose of this application is to foster the higher productivity of teaching and to help students learn more effectively when only one computer is available for a single classroom. In this situation, the computer can be used to (a) make dazzling presentations, (b) enliven demonstrations, (c) illustrate ideas and concepts, (d) encourage student participation, (e) manage and organize information, and (f) assist in classroom management by making and projecting engaging presentations (Dockterman, 1990, p. 119).

Meeting the criteria for this component has the advantage of minimizing costs and simplifying the job of teachers. The use of a single computer for presentation purposes also allows teachers to clearly illustrate concepts that their students might normally find difficult to understand. This use would save valuable instructional time, as teachers no longer would have to draw and write on the blackboard or overhead projector information that is both important and required for each class to learn (Smith, 1995).

This use of computers would (a) facilitate on-task academic discussions, (b) manage dynamic cooperative learning activities and (c) inspire enlightening self discovery. Students can make use of the computer using the tutor applications (Drill and Practice, Simulations, Tutorials, Instructional Games, and Problem Solving) in small groups or in large groups (Picciano, 1994, pp. 89-92).

As the above reveals, a single computer can and should be used as a tool for instructional planning, delivery, assessment and management. Students can and should use it as an aid to learning. In addition, a single computer can play a significant multiple roles in establishing and maintaining a powerful academic as well as social environment in the classroom.

Needed Knowledge Bases and Skills for Teachers. - In order for the teacher to make effective and fruitful use of computer in one-computer classroom, he or she needs to have command all the following computer skills. The skills listed below are based upon the opinions of the specialists in the field and research findings (Furst-Bowe, Boger, Franklin, McIntyre, Polansky & Schlough, 1995-96; National Institute For World Trade & The New York Institute of Technology, p. 21):

- Basic Knowledge And Skills
  - Essential Keyboarding Skills
  - Use Windows operating system
  - Use DOS Commands
  - Use Macintosh operating system
  - Start software program
  - Copy files
  - Install new software on the computer
- Intermediate Knowledge And Skills
  - Word Processing
    - Create and edit text
    - Arrange information in reports in ascending/descending order
  - Spreadsheets
    - Enter data into existing spreadsheet
    - Create new spreadsheet
    - Create functions/formulas for spreadsheet
    - Create charts/graphs using information from a spreadsheet
  - Database
    - Enter data into one or more existing databases

- Create new databases
- Create functions/formulas for a database
- Prepare reports using information from a particular database

- Information Retrieval
  - Locate and retrieve information over the Internet

- Advanced Knowledge And Skills
  - Graphics/Multimedia
    - Draw simple shapes and objects
    - Draw complex objects/illustrations
    - Create charts, graphs, diagrams, flowcharts
    - Create presentation materials, or overhead transparencies
    - Create multimedia presentation

Another necessary basic skill for a particular teacher may include the ability to implement cooperative learning techniques in the classroom.

Needed Knowledge Bases and Skills for Students. - When students do not have the above computer skills, then only the teacher will be able to use the computer to enhance learning. When students do have some or all of these skills, they can utilize the computer, in small groups, do projects, simulations, presentations, and much more.

2. CAI in the Multiple-Computer Classroom

Description of this component. - This component is relevant in classrooms that have more than one computer. Here, computers can be used as both tools and tutors. Students can utilize the computers individually or in small groups. This component is illustrated in Figure 5.

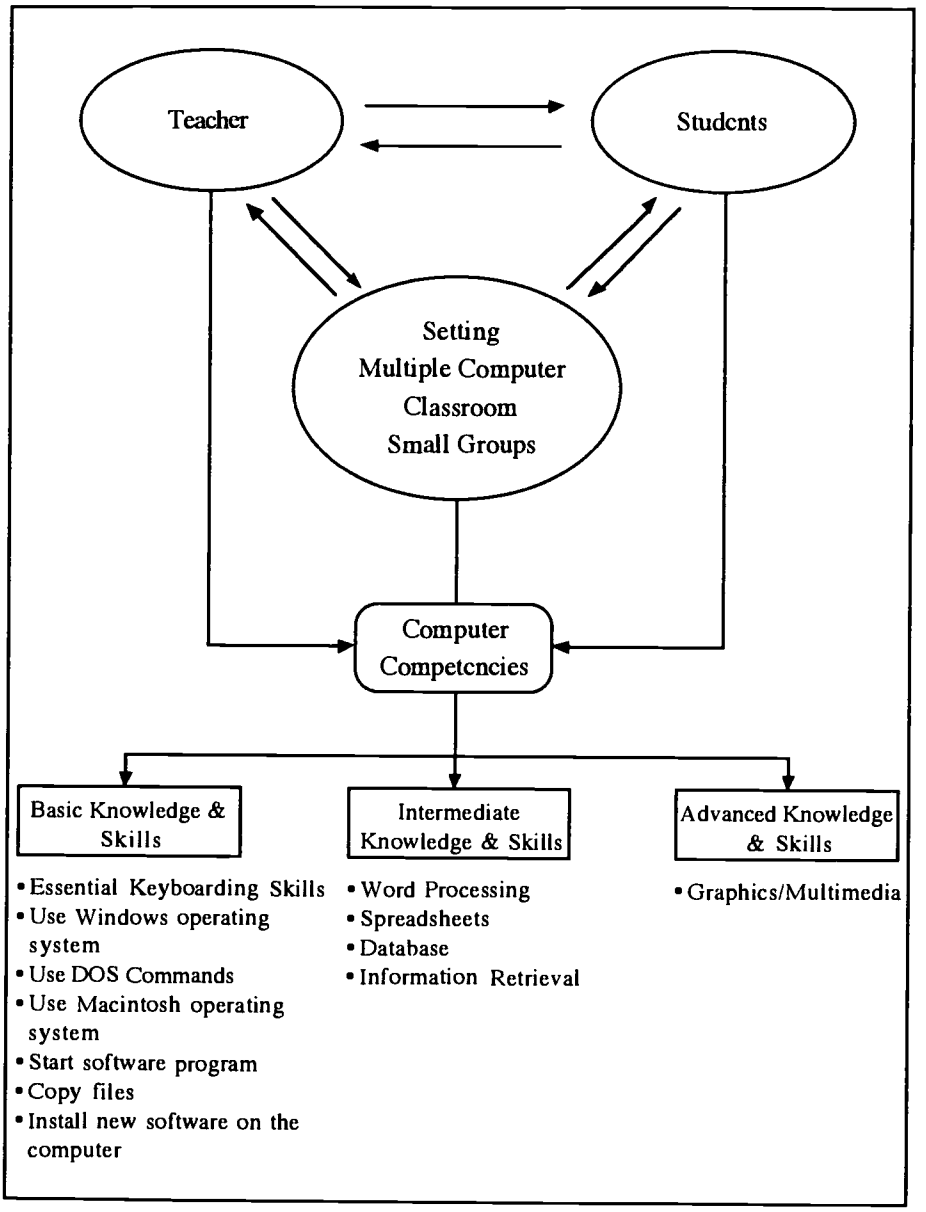

Figure 5: CAI in the multiple computer classroom

Purposes of this component. - The main purpose of this component is to increase access to computers effectively and fruitfully in the classroom (Wizer, 1995). In this situation teachers are encouraged to incorporate computers into the instructional process by having students use computers either frequently or occasionally in the natural flow of classroom activities. For instance, in a science lesson, some students use science probeware to analyze the causes of temperature changes, as a second group works on possible hypotheses to explain the phenomenon, while the teacher is engaged with a third group providing them with insight into the history of thermodynamics. Also, computers in the classroom can be used as a tutor providing either enrichment, remedial, or advanced work to small groups of students as required (Smith, 1995; Steinberg, 1991, p. 2).

This application has the advantage of providing students learning in the groups more access to computers. Eventually students who are learning in groups can intensively interact with each other. Being responsible for their own and each other's learning, they learn to understand each other as well as master academic content (Male, 1993). When they study the to-be-learned content, they use data from the computer as well as from each other. Also, this component enables teachers to provide students tutorial help individually and to act as troubleshooters.

Needed Knowledge Bases and Skills for Teachers. - In order for the teacher to function effectively in his or her roles in multiple computer classrooms, s/he needs to have command all the computer skills reported on pages 41-43. Beside these computer skills, teacher

should have the ability to implement cooperative learning techniques in order for the students to make maximum use of computers in the classroom.

Needed Knowledge Bases and Skills for Students. - If students want to utilize computers effectively in the multiple computer classroom, the researchers suggest that they have computer skills mentioned on pages 41-43. Also, students will eventually need training in collaborative processes in order to be effective in small group collaborations and task completing skills involving computers (Hooper, 1992).

3. CAI in the Separate Computer Laboratories

Description of this component. - In these situations, a number of pieces of computer equipment are gathered in a single room, that is centrally located and is available to groups of students of the school but in a room separate from typical classrooms. Classroom teachers are expected to access the computing resources they need by moving their classes to the computer laboratory. Time usually will need to be scheduled well in advance of use. The class is brought to the laboratory so that a whole class of students can work on a lesson at the same time (Bitter, 1989, pp. 73-74; Geisert & Futrell, 1995, p. 178). This component is illustrated in Figure 6.

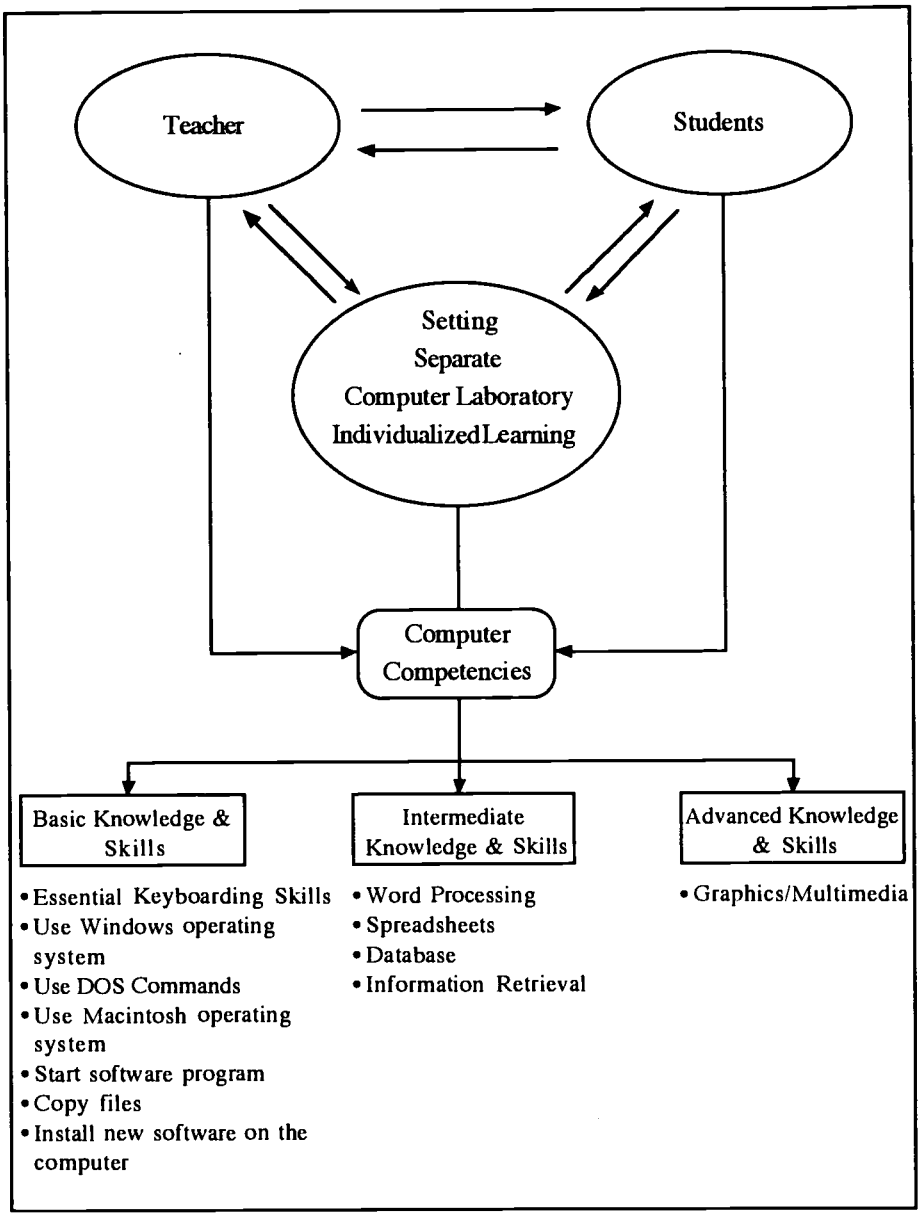

Figure 6: CAI in the separate computer laboratories

Purposes of this component. - This component provides advantages for students such as (1) possibly one computer per student, (2) good control over what is taught because all students are likely to be using the same program, (3) the possibility of having a resource person available who is responsible for general care and handling of the machines, and (4) allowing student a relatively high number of computing minutes per period. Beside these advantages, computer laboratories enable teachers to individualize instruction in their classes. These laboratories can also be arranged as tool laboratories providing software such as word processing, spreadsheets, database, and graphics. Thus, they may be utilized for all subject areas or dedicated to a particular subject area such as science, mathematics, or physics. In these laboratories, students analyze data and create meaningful reports. For example, science students may formulate hypotheses, collect data, and then analyze the data in order to determine whether the hypothesis under consideration is viable and supportable.

Needed Knowledge Bases and Skills for Teachers. - In order for the teacher to utilize effectively the computers in the computer laboratory, s/he will need to command all the computer skills reported on pages 41-43. Beside these computer skills, teacher should have the ability to implement individualized learning techniques in order for the students to make maximum use of computers in the laboratory.

Needed Knowledge Bases and Skills for Students. - If students want to utilize computers effectively in the separate computer laboratory, they will need the computer skills mentioned on pages 41-43. This knowledge base, when adequately developed at the basic skill

stage, will provide the essential foundations for building students' abilities at the intermediate stage.

Epilogue

In conclusion, this model provides three opportunities for computer use in the classroom. In schools which are at the early stages of computer development, CAI in the one-computer classroom may suffice. As computers are added to schools, CAI in the multiple-computer classroom may provide the appropriate model. For those schools having a large number of computers, CAI in the separate computer laboratory model is, perhaps, another choice. All three varieties of the model have pedagogical strengths. This three step model is needed and can be used to guide decisions in middle and high schools in Turkey.

Appendix A

LIST OF THE SCHOOLS IN WHICH CAI APPLICATIONS WERE OBSERVED

I. Middle Schools
- Apprende Middle School (Kyrene School District)
- Akimel A-al Middle School (Kyrene School District)
- Ingleside Middle School (Scottsdale Unified School District)
- Mohave Middle School (Scottsdale Unified School District)
- Mountainside Middle School (Scottsdale Unified School District)

II. Junior High Schools
- Gilbert Junior High School (Gilbert Unified School District)

III. High Schools
- Marcos de Niza High School (Tempe Union High School District)
- Tempe High School (Tempe Union High School District)

Appendix B

OBSERVATION FORM

School : _____ Grade : _____

Teacher : _____ Date : _____

Class : _____ Time : _____

1. What is the number of the students in the classroom?
2. What is the number of the computers in the classroom/laboratory?
3. What types of computers are used in the classroom/laboratory?
4. Are there printers, modems, overhead projectors, etc. ? Describe the equipment .
5. Describe the location/arrangement of the equipment in the room.
6. For what purposes are computers used in the classroom/laboratory settings?
7. How are computers used to teach within the disciplines?
8. What software was used? And why?
9. Which teaching methods/techniques were implemented to teach with computers?
10. What types of problems were noted in the classroom and how these problems were solved.

Appendix C

LIST OF THE INTERVIEWEES

I. Gilbert Unified School District
- Allan J. Merril (Manager, Computer Services)
- Gayle Ribbe (Instructional Technology Coordinator)
- Dominic Salce (Gilbert Junior High School, Computer Technology Director)

II. Kyrene School District
- Robert Troidle (Assistant Director, Information Systems & Educational Technology)

III. Mesa Public School District
- Janine Muto (Instructional Technology Director)
- Michelle Disbrow (Mountain View High School, English Teacher)
- Charley Doubek (Mentor Teacher)
- Tom Garett (Mentor Teacher)
- Marian Hermerath (Mentor Teacher)
- Cathy Toller (Mentor Teacher)

IV. Scottsdale Unified School District
- Mark share (Director of Information Services)
- Ruben Lara (Ingleside Middle School, Principal)
- Kay Berry (Ingleside Middle School, Computer Specialist)
- Jim Giles (Ingleside Middle School, Industrial Technology Teacher)
- Sharan Swenson (Mohave Middle School, Mentor Teacher)

- Charlene Greene (Mohave Middle School, Computer Teacher)
- Carol Watrous (Mountainside Middle School, Media Specialist)
- Cindy Hans (Mountainside Middle School, Computer Specialist)

V. Tempe Union High School District
- Mark Svorinic (Director of Information Systems & Technology Office)
- Ed Anderson (Marcos de Niza High School, Computer Coordinator)
- Tony Kappas (Marcos de Niza High School, Mathematics Teacher)
- Brian Tracey (Marcos de Niza High School, Business Teacher)
- Paul Plummer (Tempe High School, Computer Coordinator)
- Heather Glaesar (Tempe High School, Business Teacher)
- Dr. Gary Hall (Tempe High School, Business Teacher)
- Douglas Taysom (Tempe High School, Technology Teacher)

Appendix D

INTERVIEW QUESTIONS ANSWERED BY THE DIRECTORS OF ACADEMIC SERVICES INFORMATION SYSTEMS & TECHNOLOGY OFFICES IN THE SCHOOL DISTRICTS

1. Please introduce yourself briefly.
2. How many schools are there in your district ?
3. What is the number of the students in this district ?
4. What is the number of the teachers in this district ?
5. Do you have computer laboratories in the schools of your district ?
6. What is the number of the computers in the schools of your district?
7. What types of computers are used in your schools ?
8. Do you have access to the Internet in your schools ?
9. Is there anybody who is responsible for monitoring or repairing computers in the schools ?
10. Where does the funding come from ?
11. For what purposes do teachers in your district use computers ?
12. Which subjects are best taught using computer based technology ?
13. What types of software do you use in the schools of your district ?
14. What types of problems do you encounter with using computers in your district ?
15. How can computers be integrated into the instruction ?
16. How do teachers in your district gain computer skills ?
17. What motivates teachers to gain computer skills ?
18. What are the best ways to train teachers in order to gain computer skills ?

Appendix E

INTERVIEW QUESTIONS ANSWERED BY THE SCHOOL PRINCIPALS AND/OR COMPUTER COORDINATORS

1. Please introduce yourself briefly.
2. Can you give information about the school briefly ?
3. What is the number of the students in the school ?
4. What is the number of the teachers in the school ?
5. Do you have a computer laboratory in the school ?
6. Do you have computers in the classrooms of the school ?
7. What is the number of the computers in the school ?
8. What types of computers are used in the school ?
9. Do you have access to the Internet on the campus ?
10. Is there anybody who is responsible for monitoring or repairing computers ?
11. Do the students take a course in order to gain computer skills ? If they do, how many hours do they take it a week ?
12. For what purposes do teachers in your school use computers ?
13. Which subjects are best taught using computer based technology ?
14. What types of software do you use in this schools ?
15. What types of problems do you encounter with using computers in your school ?
16. How can computers be integrated into the instruction ?
17. How do teachers in your school gain computer skills ?
18. What motivates them to gain computer skills ?
19. What are the best ways to train teachers in order to gain computer skills ?

Appendix F

INTERVIEW QUESTIONS ANSWERED BY THE TEACHERS AND/OR MEDIA SPECIALISTS

1. Please introduce yourself briefly.
2. What do you teach ?
3. Which grade do you teach ?
4. What types of media do you use in your classes ?
5. How does using media in the class motivate the students ?
6. Which subjects are best taught using computer based technology ?
7. For what purposes do you use computers ?
8. What are the advantages of using computers to teach with ?
9. What are the disadvantages of using computers to teach with ?
10. What types of software do you use in your classes ? And why ?
11. Which techniques seem to work best ?
12. What types of problems do you encounter with using computers in your class ?
13. How can computers be integrated into the curriculum ?
14. What motivates students to gain computer skills ?
15. How do your students gain computer skills ?
16. How did you (as a teacher) gain computer skills ?
17. What motivates teachers to gain computer skills
18. What are the best ways to train teachers in order to gain computer skills ?

Appendix G

A SAMPLE OF OBSERVATION RECORD

School : _____ Grade : 6th

Teacher : _____ Date : May 22nd, 1996

Class : Computer Applications Time : 11:30-12:20

1. Number of the students in the classroom: 24

2. Number of the computers in the laboratory: 28+1

3. Types of computers used in the laboratory: Apple Mac LC 520. Each computer was equipped with a CD-ROM drive and a high-resolution color monitor in one self-contained unit.

4. Printers, modems, overhead projectors, etc. Describe the equipment: There were 5 printers, 1 scanner, 1 overhead projector, 1 large screen and 1 TV monitor in the laboratory. Computers were networked to each other. Five printers served the entire network. They also had the access to the Internet.

5. Describe the location/arrangement of the equipment in the room: 28 computers and printers surrounded the room peripherally. In the center of the room, chairs were located. The teacher's computer station with overhead projector was on the teacher's desk.

6. For what purposes were computers used in the laboratory settings?: Computers were used as tools to gain word processing

skills.

7. How were computers used to teach word processing skills?: The teacher first introduced the word processing software program by projecting it to the large screen using her computer station. Then she demonstrated how she prepared her resume using that software program. After her presentation, she asked the students to create their resumes using that software program. Each student used an independent computer station. Whenever the students encountered problems they called the teacher and asked for help. So, the teacher went from one computer station to another to answer the students' questions. She acted as a troubleshooter.

8. What software was used? And why?: Students used "Microsoft Word," when they were creating their resumes. Because this software enabled students to produce, edit, save, retrieve and print the text. It was also very popular in educational settings.

9. The teaching methods/techniques which were implemented: The teacher implemented individualized instruction method in her class. Each student worked on the computer individually. When the students addressed her questions, she answered them individually and assisted each student in preparing his or her resume on the computer.

10. What types of problems were noted in the classroom and how these problems were solved?: The teacher had difficulties in answering the student's questions. Because, more than one student asked for help regarding his or her work at a time.

Appendix H

SAMPLES OF STRUCTURED INTERVIEWS

I. A SAMPLE OF THE INTERVIEW CONDUCTED WITH DIRECTORS OF TECHNOLOGY

1. Please introduce yourself briefly.
   My name is _____. I am working as a Director of Technology for _____ Unified School District.

2. How many schools are there in your district ?
   We have 17 elementary schools, 6 middle schools and 5 high schools in our district.

3. What is the number of the students in this district ?
   We have approximately 24,000 students in the district.

4. What is the number of the teachers in this district ?
   There about 1,300 teachers in our district.

5. Do you have computer laboratories in the schools of your district?
   We have 2 or 3 computer labs in middle schools and 5 or 6 computer labs in high schools.

6. What is the number of the computers in the schools of your district ?
   We have about 6,000 computers in our schools. The ratio of computer-to-student in our district is 1:4. I believe that this is a good ratio US standards.

7. What types of computers are used in your schools ?
   The vast majority of the computers in our schools are Macintosh. The rest of them are IBM compatibles. We prefer Macintosh, because it is much easier to maintain them.

8. Do you have access to the Internet in your schools ?
   Yes, we do have access to the Internet on school campuses in our district.

9. Is there anybody who is responsible for monitoring or repairing computers in the schools ?
   We have lab assistants in the schools. They are responsible for monitoring. We also have technicians for computer repairing in the district office. If their help is needed, they go to the campus and do the necessary repairing.

10. Where does the funding come from ?
    The funding comes from the tax payers.

11. For what purposes do teachers in your district use computers ?
    They use computers in preparing their slide shows, keeping students' grades, planing their lessons, and electronically communicating with their colleagues. Young teachers are using computers more than the old teachers. Because they are coming to school with more computer knowledge.

12. Which subjects are best taught using computer based technology?
    Computers can be used in teaching of all the classes, from mathematics to physical education. Language arts and social studies are probably the most popular subject using computer based technology.

13. What types of software do you use in the schools of your district?

    In our schools, teachers and kids usually use the software programs "Claris Work", "Microsoft Word", "Image Processing", "Page Maker", "Power Point" and "Hyper Studio".

14. What types of problems do you encounter with using computers in your district ?

    The problems we encounter with using computers are generally related with hardware and software. Also technology is a problem by itself, because it is changing very quickly. So we have to update the old technology with the new one.

15. How can computers be integrated into the instruction ?

    Computers can be integrated into instruction intensively by making them as part of daily life.

16. How do teachers in your district gain computer skills ?

    They either participate in inservice training programs or use computers by themselves on order to gain computer skills. We are trying to encourage them to use computers in every occasion. For instance, in our district we are allowing teachers to take computers home with them during the summer or national holidays. We are also offering computer courses for parents after school hours or during summer.

17. What motivates teachers to gain computer skills ?

In my opinion, both students' use of computers and evaluation of teachers are playing a great role in motivating teachers to gain computer skills.

18. What are the best ways to train teachers in order to gain computer skills ?

The best way to train teachers in order to gain computer skills is to provide them access to the computers. The more they practice, the more they learn. Focusing on this thought, we are conducting inservice training programs either on campus or in the district office after school hours or during the summer.

II. A SAMPLE OF THE INTERVIEW CONDUCTED WITH COMPUTER COORDINATORS

1. Please introduce yourself briefly.

My name is _____. I am teaching math in this school. I am also working as a computer coordinator on this campus.

2. Can you give information about the school briefly ?

The name of the school is _____. It is located in Tempe, Arizona. The school is about 25 years old. We currently have grades 9-12.

3. What is the number of the students in the school ?

We have about 2,200 students on campus.

4. What is the number of the teachers in the school ?
   We have approximately 100 teachers for 70 classes. We have about 100 physical classrooms on the campus.

5. Do you have a computer laboratory in the school ?
   We have five areas which are designated computer labs. We have Macintosh computers, primarily, which are networked together. Two of the labs are open to anyone on the campus. Two of the labs are pretty much reserved for business students, word processing, keyboarding and the things like that. We have also a couple of small computer labs on campus: one reserved for mathematics and science classes, one reserved for publishing classes. There about 5-12 computer in the small computer labs.

6. Do you have computers in the classrooms of the school ?
   We do have some computers in the classrooms, but very limited. Because we chose mainly to go to the lab. In the classrooms we do not have individual computer units for students, but almost each teacher has a computer station in the classroom.

7. What is the number of the computers in the school ?
   We probably have 330 computers on campus.

8. What types of computers are used in the school ?
   Seventy-five percent of the computers are Macintosh, the rest of them are IBM compatible.

9. Do you have access to the Internet on the campus ?
   Yes, but we have limited access to the Internet this year. You

know, it is not coming as fast as I hoped. I would expect that probably in the next two years, we will have access to the Internet for the students.

10. Is there anybody who is responsible for monitoring or repairing computers ?
    We have 2 full-time and some part-time lab assistant on the campus. They are working under my responsibility.

11. Do the students take a course in order to gain computer skills ? If they do, how many hours do they take it a week ?
    We do have a computer literacy course for our incoming students. It is a semester long for 18 weeks. It is one hour for everyday.

12. For what purposes do teachers in your school use computers ?
    They use computers for lesson plans, preparing slide shows for presentation, keeping students' grades, and the thing like that. They also use computers to gain students computer skills and to enhance their teaching.

13. Which subjects are best taught using computer based technology?
    In my opinion, mathematics is best taught using computer based technology. Particularly in teaching abstract concepts in math, the computer helps students to learn better and more easily.

14. What types of software do you use in this schools ?
    We use "Claris Work" and "Micro Soft" software programs on

campus. Business teachers prefer to use the software program "Microsoft Excel" for spreadsheets. Language art teachers prefer to use "Microsoft Word" for word processing.

15. What types of problems do you encounter with using computers in your school ?

    We usually have hardware and software problems. Sometimes the computer systems are down. Sometimes the software program is technically faulty.

16. How can computers be integrated into the instruction ?

    The integration of computers is mainly based upon the teachers. If teachers use computers, kids use computers. I mean that the integration of computers into instruction will be possible only when computer become a regular part of instruction in the classrooms.

17. How do teachers in your school gain computer skills ?

    We periodically conduct inservice programs such as "Computer Literacy" courses after school hours to faculty members on the campus. We also organize some workshops during the summer in order for them to gain computer skills.

18. What motivates them to gain computer skills ?

    I think some factors such as (a) students' use of computes', (b) use of computers by their colleagues, and (c) evaluation of teachers motivate them to gain computer skills.

19. What are the best ways to train teachers in order to gain computer skills ?

I think the best way is to give them inservice training. For instance, we offer "Computer Literacy" courses after school hours for our teachers. We also organize some workshops during the summer in order for them to gain computer skills. If our help is needed, we are always ready to help them in gaining computer skills or solving their problems concerning the computer use in their classes.

III. A SAMPLE OF THE INTERVIEW CONDUCTED WITH THE TEACHERS

1. Please introduce yourself briefly.
   My name is _____. I have been working as a computer teacher for _____ middle school in _____ Unified School District for ten years.

2. What do you teach ?
   I teach "Keyboarding," and "Computer Applications".

3. Which grade do you teach ?
   I teach K-6, 7 and 8 grades.

4. What types of media do you use in your classes ?
   I use Audio/Video, computer generated presentation and CD-ROM in my classes. We have specific tool software packages to teach computer application skills. These packages include: Clariswork, Hyper Studio, All-the-Right-Type, and Adobe Persuasion.

5. How does using media in the class motivate the students ?
   Students are highly motivated when alternative media are used such as computers.
   Students are even more motivated when they can utilize the computer on a personal basis. In the general classrooms, computer generated presentations, etc. seem to bring more attentiveness to classroom information and instruction.

6. Which subjects are best taught using computer based technology?
   "Computer applications" is one of the most popular classes which utilize computer based instruction. Other areas that rely heavily on computer-based instruction would be math and science. These areas utilize a number of different computer programs for enrichment.

7. For what purposes do you use computers ?
   I use computers in planning my lessons, keeping students' grades, preparing slide show presentations and electronically communicating with my colleagues.

8. What are the advantages of using computers to teach with ?
   Computers need to be used as learning tools that enrich the information being presented. Computer can be used in a number of different way in the school. Advantages would include instant gratification, constant feedback, student enthusiasm, teacher organization, etc.

9. What are the disadvantages of using computers to teach with ?

Many people rely on computers to present information. Computers do not to take the place of the teacher, but enhance the curriculum. Students sometimes pay less attention to the instructor and more attention to the computer screen. This could be a problem when complicated issues are being discussed.

10. What types of software do you use in your classes ? And why ?
    In "Keyboarding" class, I generally use "All-the-Right-Type" software. Because, we have this software on the campus. I believe that it is very useful and practical. In "Computer Application" classes I use "Microsoft Word". For instance, it is very easy to prepare a resume using this software.

11. Which techniques seem to work best ?
    I am using computer lab for my classes. Everybody in the classroom has access to an independent computer station. So, I am trying to do my best to individualize instruction in my classes. Of course, one-on-one teaching is the best. Because kids will easily gain "hands on experience" using an independent computer station.

12. What types of problems do you encounter with using computers in your class ?
    The problems are related with both hardware and software. Sometimes, the systems are down, sometimes the software program is technically faulty. But the main problem I encounter in the classroom is the "security issue." Because, it is difficult to keep students out of each other's files.

13. How can computers be integrated into instruction ?

Teachers are the key people in the integration of computers into instruction. Because Instruction in the classroom starts with the teacher and ends with him or her. If the successful integration of computers into instruction was expected, these technologies and their usage must be taught to the teachers.

14. What motivates students to gain computer skills ?

Today's students have grown up with technology. They will learn to use various applications as necessary to complete an assignment. Some love working with technology want to do nothing else. From my experience, if there is any "push," it is teachers who "push" students to gain computer skills.

15. How do your students gain computer skills ?

In our country, kids gain computer skills either at home or at school. For instance, they take "Computer Application" in both 7th and 8th grades.

16. How did you (as a teacher) gain computer skills ?

I have been utilizing computers for 10 years. I have taken a number of classes in computer applications and computer education. My advanced degree programs also utilize computer technology and computer education.

17. What motivates teachers to gain computer skills

When computers are placed in the classroom, teachers seem to want to use the box. Our district has created a number of computer classes that teachers can participate in. The district

allows teachers the opportunity to receive staff development credit -- which leads to an increase in salary over time.

18. What are the best ways to train teachers in order to gain computer skills ?

    The best way to train teachers is to give them inservice training. For instance, we offer classes after school hours on the campus. Teachers learn best when they need to learn the skill for a particular application, such as a paper or project for graduate work or master's degree. Teachers need to have regular access to computer in order to main their skills.

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In order to achieve effective computer education and computer-assisted instruction (CAI) applications in schools, models to ensure the use of CAI in classrooms must be designed and implemented in educational settings. Focusing on this thought, the researcher aimed to propose a CAI model for middle and high schools in Turkey based on the observations and interviews in K-12 schools in Arizona, USA in which computer technologies are implemented effectively. The model consists of three major components. These components are (1) CAI in the one-computer classroom, (2) CAI in the multiple-computer classroom, and (3) CAI in separate computer laboratories.

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