IMPLEMENTATION ISSUES IN THE INTRODUCTION OF COMPUTERS INTO THE IRANIAN EDUCATION SYSTEM

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy
Department of Curriculum, Teaching and Learning
The Ontario Institute for Studies in Education of the University of Toronto

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Dedication:

This thesis is dedicated to the memory of my father, Abbas Zamani, who was an inspiration to me, and who taught me the importance of higher education for women and to strive for higher goals in life.
Implementation Issues in the Introduction of Computers into the Iranian Education System

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ABSTRACT

This study investigated the introduction of computers into the Iranian educational system, the rationale for introducing the Computer Studies course, and most importantly, the implementation process. The first main focus of the study was to identify the factors and conditions that were important in the computer implementation process. The second focus was to examine how these factors relate to models of implementation of innovation, particularly to Fullan’s model which was used as the theoretical framework, and to examine the strengths and weaknesses of his model as applied to the situation of Iran and other developing countries.

Participants were samples of different groups involved in the innovation, namely policy makers, principals, teachers, computer lab managers, students and parents. The data collected consisted of questionnaires, semi-structured interviews, policy documents and on-site observations in Iranian high schools in Isfahan (one of the largest Iranian cities). The high rate of questionnaire returns and interview participation demonstrated the participants’ interest in cooperating to improve the computer education in Iranian high schools.

The results of the study confirm that the identified implementation issues in using computers in Iranian schools were similar to those in other developing countries, e.g., lack of
hardware, software and maintenance, lack of trained people, lack of clarity about the objectives, motivational problems, gender inequity in relation to using computers, and the programming language used as well as the little educational software that was available was in English and culturally inappropriate. The findings also indicated that certain characteristics of the Iranian situation that strongly influenced the implementation process are not emphasized, or overlooked in the theoretical assumptions of the more common models of implementation derived from experience in western industrialized countries. On the basis of these findings, the researcher offered suggestions both for additional elements to be considered in formulating theories of implementation for developing countries and for measures to be taken by national authorities such as those in Iran for coping with technological change in schools. The study was innovative in that it examined the role of situational factors, in particular factors of traditional societies in transition: socio-economic, socio-cultural factors and political stability, in the implementation of technological change. The data provided substantial evidence for the importance of socio-cultural and socio-economic factors in the implementation of the Computer Studies course. However, political stability was not dealt with in-depth and needs more research. Any implementation model should take into consideration the role of situational factors in a given society.
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ABBREVIATIONS

CAI: Computer Assisted Instruction
CSC: Computer Studies Course
KAD: The initials of two Persian words for work and knowledge
SES: Socio-economic Status
UEE: University Entrance Exam
CHAPTER ONE

INTRODUCTION TO THE STUDY

During the early 1980s, many western countries introduced increasingly large numbers of microcomputers into their schools. As industrialized nations moved rapidly toward utilizing computers in their education systems, the governments of developing countries began to be concerned about being behind. These governments are concerned that if computers are not introduced into their countries, the gap between their societies and those of the industrialized nations will become even wider. In an effort to address this problem most of the developing countries like Iran have incorporated computers into their educational systems.

Although much research has been done on different aspects of introducing the computer technology into educational systems of industrialized countries, this is still a new area in developing countries which needs more research (Chaundry and Fakhro, 1989; Makau, 1990; Oliveria, 1990; Oteiza, 1993). The use of computers in the Iranian education system as in the other developing countries is relatively new. The present study is about the introduction of computers into Iranian high schools. This study took place in one of the biggest Iranian cities, namely Isfahan.

1.1 Background: Computer Implementation in Iranian Education System

1.1.1 Iranian Schools

Iran, which was known as Persia until 1935, is located in the Middle East region of south Asia and covers an area of 1,648,195 square kilometers. The capital is Tehran. According to the 1996 census, the population of Iran is 59,500,000. About 57% of the population live in urban areas and the rest live in rural areas. The age profile is biased strongly towards the younger years, with 10 million people of school age. Oil revenue is the main source of the country's income. According to the constitution, the official language and script of Iran is Persian (Farsi). Persian is also the medium of instruction.

School education in Iran is based on 4 cycles: Pre-Primary Education (5 years old), Primary (6-10 years old), Guidance (11-13), High Schools (14-17). The Ministry of Education generally maintains centralized control of all aspects of education other than post secondary
education. For example, it recruits all teachers, administers the final examinations at the end of each cycle, and provides all educational resources including text books which are given out free of charge to children in the elementary cycle and at low cost to students in the Guidance and High school cycles. More information about the educational system of Iran will come later in this chapter.

1.1.2 Computer Education in Iran

The use of computers in Iranian high schools is relatively new. In 1988, with the spread of computers in Iranian society, some private primary and secondary schools got equipped with computers, although there were no specific objectives for using them (Head of Computer Group in Tehran, 1995). The spread of computers in the Iranian society was surprisingly fast, resulting in a need for computer literacy studies in secondary education.

The Ministry's initial foray into computer education was taken in 1990-1991 when a pilot project was started in the central cities of 25 provinces introducing a computer literacy course to grade eleven students in the Math/Physics focus. In 1991-1992 this project was extended to half the students in grade 11 of Math/Physics, and by 1992-1993 all of the students in the Math/Physics focus were covered by this course.

The purpose of this course was to enable students: (1) To gain a preliminary understanding of the fundamentals of computers, and the role of computers in modern society; (2) to master the BASIC language and to develop programming and debugging skills; (3) to develop logical thinking, problem solving ability and creativity. In 1993, about 55,000 students in all Iranian high schools in the Mathematics/Physics focus were covered by this program.

According to the Iranian policy makers, all students graduated from the high schools should have some knowledge about computers; therefore, the Iranian Ministry of Education has the long term intention to implement this course for students in other foci: for example, Science, Arts and Literature in high schools. Computers have also been used since 1993 in other fields such as for administrative tasks in Iranian high schools.

1.1.3 Implementation Issues

Even though a lot of attention has been paid to introducing computers into the Iranian educational system, little is known about the actual use of computers and the complex issues which surrounded their implementation. Past experience has indicated that most change efforts in the Iranian educational system were focused on the development and introduction of change
(e.g. a new curriculum or a new method) in the schools, but what happened after the introduction of the innovation was not seriously examined. For instance, in 1973-1974, a considerable investment was made in equipping schools with audio-visual equipment and materials. Unfortunately, the equipment stayed in the principals' offices and never came out for students' use. No research was carried out during the project to see what was happening during the implementation process, what problems existed in the use of audio-visual materials or why the attempt failed.

According to McGee (1987), one reason for the failure of implementing technological innovation might be because of administrators' lack of understanding of the importance of the implementation process. Lack of emphasis on implementation has also been discussed by other researchers:

An examination of change in education reveals that a majority of the effort to effect change has focused on the development and adoption processes. Too little attention has been paid to what happens to innovations after they reach the classroom (the implementation process) (Whiteside and James, 1986, p.29).

The purpose of this study was to examine the implementation issues surrounding computer introduction and use in Iranian high schools, to identify which factors and conditions are important for the success of the implementation process, and to see whether the results are consistent with findings of other researchers on educational use of computers in other developing countries.

1.2. Theoretical framework:

Prior to the 1980's, there was little, if any, research focusing on the implementation process. Some researchers pointed to the lack of research about the implementation process (Fullan and Pomfret, 1977; Gross and Bernstein, 1971; Godleweski, 1989; Huberman and Miles, 1984; Jablonski, 1980). William Hargrove described the process of implementation as the "missing link" of planned change that received infrequent attention (cited in McGee, 1987).

Kritek (1976) regarded implementation as the central issue in the effort to carry out educational reform (Jablonski, 1980). According to Hargrove, serious effort should be made to define problems/issues "associated with the implementation process or to pinpoint variables responsible for the success or failure of program implementation" (cited by McGee, 1987, p.190). According to Gross and Bernstein (1971), "It is important to examine and understand the circumstances and conditions facilitating and blocking implementation" (cited by Jablonski,
Implementation was the focus of Fullan's studies during the past two decades. The present study uses Fullan's theory of implementation of change as a theoretical framework (Fullan, 1985, 1991). Fullan (1988, 1992) discusses and adapts his theory to deal with the implementation of microcomputers in Ontario schools. In Fullan's model ten factors are identified as affecting the implementation phase of significant changes. Figure 1.1 (adapted from Fullan 1992, p.30), presents these factors.

**Figure 1.1: Factors Influencing Implementation**

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<tr>
<td>1. Clarity and complexity</td>
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<td>2. Consensus and conflict about the change</td>
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<td>3. Quality and practicality of the change</td>
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<td>4. Central office direction, commitment and support</td>
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<tr>
<td>5. Process for implementation and institutionalization</td>
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<td>6. Professional development and assistance</td>
</tr>
<tr>
<td>7. Implementation monitoring and problem-solving</td>
</tr>
<tr>
<td>8. Principal's leadership</td>
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<tr>
<td>9. Community support</td>
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<td>10. Environmental stability</td>
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Fullan's general theory (1985, 1991) and his application of the model to the Ontario study of computer implementation (1988, 1992) were chosen as the conceptual base for this study for the following reasons: (i) the framework was seen as useful in identifying and describing the content and process of change; (ii) Fullan's model includes the main elements required for studying a top-down approach to change of the type used in the Iranian educational system, which is highly centralized; (iii) the framework has already been tested and found workable in other research (e.g. Plomp and Carleer, 1987). This study was not designed to test Fullan's model of computer implementation in education but rather to use it as an organizing framework for design, data collection, and interpretation.

Fullan's theories are examined below (Chapter Two, Literature Review) in the context of
other writings related to change process and technological innovation in non-industrialized (developing) countries.

1.3 Statement of the Problem

This study investigates how computers were introduced into the Iranian educational system, the rationale for introducing computers, and most importantly, the implementation process. The first main focus of this study was on identifying which factors and conditions were important for the success of computer implementation in the Iranian educational system.

The second focus of this study was on examining how these factors relate to models of implementation, particularly to Fullan’s model, and to examine the strengths and weaknesses of his and other theoretical models as applied to the situation in Iran. The researcher argues that certain characteristics of the Iranian situation that strongly affected the implementation process are not emphasized or are left out of the theoretical assumptions of the more common models of implementation derived from experience in western industrialized countries. On the basis of this examination, the researcher formulates suggestions both for additional elements to be considered in developing theories of implementation and for measures to be taken by national authorities such as those in Iran for coping with technological change in schools.

The first focus---developing a rich data base for examination of the implementation process in Iran---is best understood in the light of the main questions being addressed during the initial phases of data gathering and analysis: How do Iranian high schools presently use computers in instruction and learning? What are the policy makers’, principals’, teachers’, parents’, students’ and lab managers’ views regarding: (a) rationale for using computers in education; (b) availability of computer resources, support and staff development; (c) problems involved in introducing computers into the schools, and finally (d) gender equity issues related to computer use in Iranian high schools. The following overarching questions serve as a guide to answering the research problem: What values, resources, procedures, activities, strategies and conditions are perceived by the participants as facilitators or obstacles in the implementation of computers? How are these factors seen as helpful or inhibitory?

Research questions are amplified in Figure 1.2, distinguishing between (A) elements that are mainly descriptive; (B) problems as they are perceived by administrators, teachers and students, and (C) the implementation process.
Figure 1.2. Expanded Statement of Questions to Orient Study

(A) Description of present status of computer use
For all questions a distinction was made according to the major sampling variables: public vs. private schools, girls’ schools vs. boys’ schools.

1- What are the stated objectives of introducing computers in education?
   - at present
   - for future

2- What are current patterns of use?
   - students by stream (who is left out?)
   - by subjects
   - by gender
   - by public/private

3- What is the present teacher training situation?
   - formal training of teachers already teaching (how much received, currently)
   - available training facilities / programs for teachers
     - pre-service
     - in-service

(B) Present areas of perceived education problems

1- Use and availability
   - computers
   - software
   - technical support and leadership

2- Teacher competencies and training
   - for teaching with and about computers
   - for using computers in other subjects and linking with curriculum

3- Classroom patterns of use

(C) Implementation process
Topics for inclusion in data gathering (not an exhaustive list):
   - timing and announcement of introduction of computers
   - preparatory measures of introduction
   - problems in first application (i.e. 1st year)
     - technical
     - human
     - pedagogical
   - problems after first year
   - roles of teachers, administrators, others in the process.
1.4. Rationale for this Study

The study is intended to contribute to knowledge by examining factors that contribute to the success of computer implementation in education, particularly in developing countries (many of which have a situation similar to that of Iran). It should be noted that no studies about the introduction of computers into schools have been conducted specifically with the Iranian population. The results will be useful in extending or critiquing theories of implementation of innovation, particularly, that of Fullan (1988, 1992). Some factors discussed in this study may be unique and have not attracted much attention from other researchers.

Although much research has been conducted on different aspects of using computers in education in industrialized countries, the educational use of computers in many developing countries is in its experimental stages and there is little research on the educational use of computers in these countries. Therefore, the information from this study will be useful to other developing countries in a state of development similar to that of Iran.

Because of economic problems, every investment by the developing countries’ governments must be considered carefully. Past experiences are valuable for preventing the repetition of past mistakes. Without enough information, it is difficult to make rational policy decisions. Therefore, the results of this study should provide an additional valuable source of knowledge for the educational policy makers in Iran. Moreover, this study could help planners: (a) by clarifying a process that continues to perplex them, and (b) by providing theoretical guidelines so that an innovation has a greater likelihood of success.

1.5 Definitions and Abbreviations

A list of commonly used abbreviations is included at the beginning of the thesis, immediately after the table of contents: This section presents working definitions of the terms that are used in this study.

Computer assisted instruction (CAI) is used to mean the augmentation of instruction with computer aided strategies in the areas of drill and practice, tutorial, simulation and game techniques (Wright and Forcier, 1985).

Computer literacy is knowledge about the history of computers, the potential use of computers, the technical aspects of hardware, taxonomies of educational software, skills in operating computers, and basics of programming, and the role of computers in society (Callister JR and Burbules, 1990).
**Developing country** is a country that is capable of greater substantial improvements in its income level and is in the process of achieving these improvements (Kindleberger and Herrick, 1977).

**Implementation:** "Implementation consists of the process of putting into practice an idea, program, or set of activities new to the people attempting or expected to change" (Fullan, 1982, p.54)

**Innovation:** A new or revised curriculum, a policy, a structure, an idea, is something that is new to the people encountering it for the first time (Fullan, 1992, p.22).

**Model:** A symbolic and/or descriptive representation of a process whose purpose is to simplify the process and make it more certain (Jablonski, 1980, p.11)

### 1.6 Overview of the Thesis

This thesis is organized in the following way. The remainder of this introductory chapter provides the background on the Iranian educational system necessary for understanding the discussion that follows. In Chapter Two, literature on relevant theory and research are reviewed in three parts. First is a general review of literature on the process of innovation. Then, the literature review focuses on the factors that influence the success of implementation and possible obstacles that may exist in computer implementation in education. Next, the implementation issues in using computers in developing countries are studied. Chapter Three describes the design and the context of the study including participants, sites, procedures used for data collection and analysis. Chapter Four presents the findings of the study, related to different groups of participants, including: policy makers, principals, teachers, lab managers, parents, students, and teachers of other subjects. Chapter Five presents a discussion on the major findings within a modified model of implementation, and examines the findings in light of previous research. Chapter Six summarizes the findings, discusses their significance and the contribution to implementation theory, then presents recommendations and suggestions for further study.

### 1.7 The Education System of Iran

The Iranian school system is under the jurisdiction of the Ministry of Education. This Ministry administers and finances schools at the pre-university level. The Supreme Council of Education, as a legislative body, is responsible for approving all policies and regulations related to schools.

There are two kinds of schools: public and private. During 1979-1990 all schools were
public. In the public schools, the government supplies more than 90 percent of the funds for education, and schools receive public allocations for materials and maintenance on a per student basis which is too small to allow for providing any teaching materials or maintenance (The International Encyclopedia of Education, 1994).

During 1980-1990 the number of students enrolled in all levels of school combined increased from 7.5 to 14.5 million (93%), causing very serious problems for the Iranian education system. To ease the financial burdens, the Islamic Consultation Assembly has an Act, permitting the private sector to establish non-profit (private) schools. These schools charge high tuition fees and provide more facilities than the public schools. The private schools must follow the same curricula and extra-curricular programs as the public schools.

Exemplar public schools: The principles of the exemplar public schools were approved by the Supreme Council of Education (Ministry of Education, 1993) in 1987. The main objective of these schools is to encourage talented students, especially those who live in socially deprived areas (rural areas), to promote their scientific and artistic aptitudes.

1.7.1 Structure of the Educational System in Iran

As mentioned, the Iranian school system consists of one year pre-primary, five years Primary (Elementary), three-years Guidance (Intermediate), and four years of Secondary (General or Technical and Vocational) education.

The main aim of primary education is teaching the basic skills of literacy and numeracy, making students familiar with simple daily regulations, teaching socio-cultural and economic concepts, and religious training. In Guidance level, students become familiar with the sciences in order to more readily find their area of interest and be able to choose their branch of study in the secondary level of education. Teaching English as a foreign language starts at the second year of the Guidance level. Primary and Guidance form two levels of general education, while secondary education is divided into two streams of general and technical/vocational education.

Secondary Education comprises four years of formal schooling for students age 14 to 17 years. After having successfully passed the requirements of the Guidance cycle, students will continue their studies in one of the various areas of the secondary level.

Presently, secondary education is divided into academic (theoretical), and technical and vocational branches. The academic program is divided into the three major branches, namely
Mathematics–Physics, Experimental Sciences, and Literature and Humanities. Students receive a diploma in one of the three branches after four years of study. Admission criteria for entering the different branches of secondary education are different according to each branch. According to these criteria, approved by the Supreme Council of Education, the Guidance graduates' grades in some special courses are calculated, and compared with the grades which are assigned as minimum required grades. The special courses for entering any given branch of secondary education are different from the special courses for entering other branches. The content of education in high school is directed to prepare students for entrance into higher education or for vocational courses at technical colleges or for taking a job. The curriculum is fixed for all students from both genders, the only difference being in the Work and Knowledge (KAD) instruction described in the next paragraph.

It is important to mention that the secondary education system is undergoing fundamental change. In 1992-1993, in the first phase of the transitional stage, 10% of students who were entering the first grade of secondary education, were registered in a number of secondary schools which were designated to offer the New Educational System. This percentage will increase each year, in order to cover the entire secondary education system throughout the country (Ministry of Education, 1993).

1.7.2 KAD: Combining Work and Education

In order to direct students into productive activities, a program titled "KAD" (the initials of two Persian words for work and knowledge) is implemented in all academic branches of secondary schools. In this program, “high school students have to participate in a work place or a profession, one day a week, for the first three years of their secondary schooling. They take part in this program about thirty days during the school year, and their apprenticeship is under the joint supervision of work place and school authorities” (Ministry of Education, 1993, p.125). The KAD programs for boys and girls are not totally similar, and they are designed according to "the capabilities of each sex as well as the cultural values which govern the Islamic society of Iran" (Ministry of Education, 1993, p.126). Boys could participate in any activities which they would like outside of high schools, but girls could take only sewing and cooking courses which were offered in their high schools.

1.7.3 Grading and Examination

The Iranian system of education requires students to take three examinations during each academic year and to pass them satisfactorily in order to be promoted to the next grade. The criterion for promotion is determined by a numerical scale (0-20). In essence, it rests on
students' efforts to earn at least a 10 point average for the three annual exams in each subject. However, if a student fails to meet this criterion, he or she will have the opportunity to retake the exam in the failed subject, close to the beginning of the next academic year. Those falling below 10 must repeat the year.

In the present system of education in Iran, certificates are conferred on students upon the fulfillment of the requirements of (1) the five year primary, (2) the three-year guidance, and (3) the four-year high school. Currently, a centralized and uniform final examination is administered for graduation at the province level for the fifth graders of primary, and eighth graders (last year of guidance schools), and at the national level for the twelfth graders (last year of high school). Textbooks are the only source of knowledge. Teachers must cover all the assigned subject matter in the classroom and students must memorize a lot of factual information. High class sizes, fixed curriculum and textbooks, and teachers' obligation to cover the assigned syllabus has resulted in a teacher-centered approach.

After completing secondary school and receiving the high school diploma, students wishing to continue on to higher education should successfully pass the highly competitive university entrance examination (UEE), held annually across the country in the summer. This exam is composed of two parts: a general and a specialized test. Usually a small percentage of the applicants are admitted into universities, e.g., in 1989-1990, there were 752,343 applicants of whom only 61,000 (8% of the applicants) were admitted to higher education institutions (Iranian Ministry of Education, 1994). Those admitted can continue their education in one of the areas of Mathematics, Natural and Pure Sciences, Humanities, Medicine, Engineering, Agriculture, and Arts, each of which is divided into many fields of specialization.

In order to compensate for this high competition, an unconventional university, called Islamic Open University (Azad University) was established in 1984. In addition, a Correspondence University (Payame Noor) was also established in 1987 with the goal of providing higher education opportunities for youths and adults who cannot attend formal classes. These two universities offer programs in different fields and for different degrees. 

1.7.4 Structure of the Teacher Training System and the Teaching Profession.

Before the Islamic Revolution (1978), different organizations were involved in teacher training. After the Revolution, teacher training became centralized in one unit called the Teacher Training Bureau, Ministry of Education (Ministry of Education, 1993).
Rural teacher training centers train primary teachers for the rural areas. The students are selected from among the native graduates of guidance schools, and are trained for their own area.

Teacher training centers select their students from among high school graduates. The applicants for these centers must pass the National Entrance Examination. Two types of teacher training centers exist: general (training teachers for primary and guidance level), and technical and vocational. After a two-year training, Associate Degrees are conferred on the graduates.

University Teacher Training Programs: Universities and higher education institutions train the teaching staff for secondary education, both in the academic and the technical and vocational branches. There are seven teacher training universities (Ministry of Education, 1993). After completing four years of study, students are awarded a bachelor degree in one of the following areas: Theology and Islamic Education, Mathematics, Social Sciences, Physical Education, Physics, History, Geography, English Language, Arabic Language, Persian Language and Literature, Geology, Biology, Chemistry, Educational Sciences and Guidance and Extracurricular Activities.

In addition to the teacher training universities, some other universities also allocate some of their resources to teacher training programs.

All teachers who teach in the secondary level have to teach 24 hours per week. Teachers may teach only within their specialization area. Therefore, teachers usually work in more than one school of their districts.

In-service Training: Updating teachers' knowledge requires training. In-service training for teaching staff consists of different programs, offered in different lengths and in different institutes. In-service training courses are offered as either short term or long term courses. Long term courses are those that lead to higher degrees. These courses are offered at the three levels of associate, bachelor, and master degrees and are offered by higher in-service training centers, teacher training centers, and the universities. Higher in-service training centers and teacher training centers offer courses during the summer at both associate and bachelor levels. Universities also offer opportunities for teacher in-service training. According to an agreement between the Ministry of Education and the Ministry of Higher Education, 80 percent of the admission capacity of science education courses at all universities in each academic year is allocated to teachers. 50 percent of the admission capacity of the Open university is also
allocated to teachers and other employees throughout the country (Ministry of Education, 1993).

1.7.5 Educational System in Isfahan:

As mentioned, in the Iranian centralized system of education, all decisions are made by the Ministry of Education, and delegated to the 25 provincial Boards of Education to execute. Within each province, education authority is further subdivided into Districts of Education under the supervision of the Board of Education. There are 34 districts in Isfahan province, and five of them are located in Isfahan city. In this section, information about secondary schools in the province of Isfahan is provided, along with information about the city of Isfahan. In total, there are 573 high schools in the province of Isfahan. Table 1.1. indicates the distribution of high schools according to the gender and type of the high schools.

Table 1.1: Distribution of High Schools in the Province of Isfahan.

<table>
<thead>
<tr>
<th>Type of High School</th>
<th># of Boys' High Schools</th>
<th># of Girls' High Schools</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public High School</td>
<td>260</td>
<td>265</td>
<td>525</td>
</tr>
<tr>
<td>Private High School</td>
<td>30</td>
<td>18</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>290</td>
<td>283</td>
<td>573</td>
</tr>
</tbody>
</table>

Of the 573 high schools, 175 are in Isfahan city. The distribution of high schools in the five districts of Isfahan city is indicated in Table 1.2.

Table 1.2: Distribution of High Schools in Isfahan City

<table>
<thead>
<tr>
<th>Districts</th>
<th>Boys' High Schools</th>
<th>Girls' High Schools</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public</td>
<td>Private</td>
<td>Public</td>
</tr>
<tr>
<td>District A</td>
<td>6</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>District B</td>
<td>10</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>District C</td>
<td>16</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>District D</td>
<td>15</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>District E</td>
<td>8</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>24</td>
<td>78</td>
</tr>
</tbody>
</table>
Of 573 high schools in the Isfahan province, only 89 high schools had a Math and Physics branch and of 175 high schools in the Isfahan city, 57 had a Math and Physics branch. Table 1.3. shows the distribution of students in grade 11 Math and Physics in the Isfahan province.

Table 1.3: Number of Students in Grade 11 Math and Physics (Isfahan Province)

<table>
<thead>
<tr>
<th>Type of High School</th>
<th># of Boy Students</th>
<th># of Girl Students</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public High School</td>
<td>3438</td>
<td>1259</td>
<td>4697</td>
</tr>
<tr>
<td></td>
<td>73%</td>
<td>27%</td>
<td>100%</td>
</tr>
<tr>
<td>Private High School</td>
<td>255</td>
<td>124</td>
<td>379</td>
</tr>
<tr>
<td></td>
<td>67%</td>
<td>33%</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>3693</td>
<td>1383</td>
<td>5076</td>
</tr>
<tr>
<td></td>
<td>73%</td>
<td>27%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The number of students in grade 11 Math and Physics in five districts of Isfahan city is shown in table 1.4.

Table 1.4: Students of Grade 11 Math and Physics in the City of Isfahan

<table>
<thead>
<tr>
<th>Districts</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public</td>
<td>Private</td>
<td>Public</td>
</tr>
<tr>
<td>District A</td>
<td>239</td>
<td>14</td>
<td>86</td>
</tr>
<tr>
<td>District B</td>
<td>796</td>
<td>64</td>
<td>264</td>
</tr>
<tr>
<td>District C</td>
<td>554</td>
<td>98</td>
<td>292</td>
</tr>
<tr>
<td>District D</td>
<td>275</td>
<td>0</td>
<td>185</td>
</tr>
<tr>
<td>District E</td>
<td>425</td>
<td>0</td>
<td>277</td>
</tr>
<tr>
<td>Total</td>
<td>2289</td>
<td>176</td>
<td>1104</td>
</tr>
<tr>
<td></td>
<td>63%</td>
<td>5%</td>
<td>30%</td>
</tr>
</tbody>
</table>

As the information indicates, 72% of students in grade 11 Math and Physics are living in Isfahan. Most students in this major are boys. 68% of students in grade 11 Math and Physics in Isfahan are male when in the province 73% are boys. Five districts in the province do not have the Math and Physics branch and some districts have this major only for boys.
CHAPTER TWO

LITERATURE REVIEW

We in the developing countries require more and more, and better education, but we cannot get either more or better, by doing the same things in education as we have done before, even though on a larger and expanding scale. That way is a blind alley (Raja Roy Singh, 1972 cited by Bishop, 1986).

The purpose of this review is to examine the literature related to the implementation of computers in education, in order to determine the existing state of theory, research and experience in this area. This chapter begins with an overview of literature on the process of innovation. Following that, there is a discussion of factors affecting the success of computer implementation in education. The chapter concludes with a literature review on using computers in education and related implementation issues in developing countries.

2.1 The Process of Innovation

The purpose of this section is to provide an overview of literature on the overall process of innovation, with particular emphasis on the implementation process.

Definitions: Some researchers distinguish innovation from change; for example, Huberman (1973) says “What distinguishes an innovation from change in general is the element of deliberate planning or intention” (p.3). Fullan (1991) in his theory of change focuses on “planned” change. He says, “I do not dwell on unplanned or naturally occurring changes” (Fullan, 1991, p. xiii). In the present study, the researcher uses the word ‘innovation’ and ‘change’ (means ‘planned change’) interchangeably. It is also important to distinguish between ‘innovation’ and ‘intervention’. The innovation is what is being implemented, the change. Interventions are what you do that facilitate and inhibit adoption of innovation” (Hall, 1981, p.16).

Diffusion vs. Dissemination: Hall (1981) defines diffusion as “the natural spread of an innovation across a social system...In dissemination there are deliberate moves to drive the spread of innovation”(p.15).

Change process: There are numerous publications, bibliographies, and research studies concerning the change process (Bishop, 1986; Drag, 1975; Fullan, 1991; Godlewski, 1989;
Havelock, 1969, 1973; Havelock and Huberman, 1978; Huberman, 1973; Kritek, 1976; Loucks and Zacchei, 1983; Maguire, 1970a, 1970b). A relatively large number of models of the process of change have been developed by various scholars. Because of the outstanding number of change models, any attempt to organize, analyze, and summarize the various models is a formidable task. Following is McClelland’s insightful overview in this regard:

It is premature to do more than wish for a general model... of change... Researchers developed a variety of subsystem models... Quite understandably, they vary widely in comprehensiveness, complexity, and elegance (Jablonski, 1980, p.24).

Maguire, in 1970b, summarized 42 change models in his book: ‘Observations and Analysis of the Literature on Change’. Havelock (1969), in a huge and comprehensive study, also presented several conceptual models that were related to the change process. In Havelock’s review (1969), 24 models were examined. Three principal models illustrating how change takes place are considered by Havelock (1973). The first model is “a theory-into- practice model or ‘research and development’ model” (Huberman, 1973, p.61). The second model is ‘social interactions’ and the third one is ‘problem solving’. Because, these three models are mentioned frequently by other researchers, a brief summary of these models is presented in the following section:

(i)- Research, Development, and Diffusion (RD & D): According to Havelock (1973), the most systematic conceptual categorization of processes dealing with educational change was developed first by Brickell and later by Hopkins and Clark under the heading of “Research, Development, and Diffusion.” This model views the change process as a rational sequence of phases, by which an innovation is developed, produced and disseminated to the user. In this approach, “The innovation is not analyzed from the viewpoint of the user ...who is presumably passive. Nor does research begin as a set of answers to specific human problems, but rather as a set of facts and theories which are then turned into ideas for useful products and services in the development phase” (Huberman, 1973, pp.61-62). The emphasis of this model is on the translation of basic research into applied knowledge. The three main factors of this model were explained by Jablonski (1980, p.26) as follows:

**Research**

(1) Conduct basic scientific research
(2) Investigate educationally oriented problems
(3) Gather operational and planning data

**Development**

(4) Invent solutions to operating problems
(5) Engineer packages and programs for education
(6) Test and evaluate solutions and programs

Diffusion
(7) Inform target system
(8) Demonstrate solutions and programs
(9) Train target systems in use of solutions and programs
(10) Service and nurture installed solutions.

In this model, “a development agency at the center ... produces packaged solutions for the users at the periphery (schools and teachers).” (cited by Bishop, 1986, p.17). The decisions about change are made at the top of the system and distributed to the bottom lines for execution. According to Bishop, this model is a highly organised approach mostly used as a model in developing countries.

(ii) The Social Interaction Model (S-I): According to Bishop (1986), in this model, decisions related to change are made through contacts among interested groups or individuals. Therefore, this model places emphasis on the aspect of diffusion through a social system. The messages move from person to person and system to systems, “The ‘innovation’ is a concrete item such as a fertilizer, a new kind of seed, a new drug, or a new curriculum package” (Havelock, 1973, p.159). According to Huberman, this approach takes the form of convincing a respected administrator or teacher of the usefulness of a new practice or a device and “then facilitating the process whereby colleagues come into contact with the new practitioner while he is using the innovation” (Huberman, 1973, p.62).

(iii)- The Problem Solving (P-S) model: This model begins with the assumption that the user has a definite need which should be translated into a problem statement and satisfied by the innovation. According to Bishop (1986), at first a need or a special problem is identified. The research is done to find the various solutions to the problem or to meet the need. After finding the solutions, one of them is selected as the best according to the resources and social, economical, cultural limitations. “Any solutions, innovations... must not only be feasible in terms of costs, etc. but must also be compatible with existing values” (Bishop, 1986, p.5). The chosen solution is implemented in a small scale (pilot) study. After revising and modifying the solution, “if promising, the solution is implemented on a wider scale...Then the solution is absorbed into the system, it is institutionalized” (Bishop, 1986, p.5). In the problem solving model, in contrast to the R, D and D model, decisions are made at the bottom lines by the users. This model is a bottom to top model.
In the ‘bottom-up’ approach advocated by some educators/researchers in industrialized countries (e.g., Means, 1994), implementors (teachers) initiate the innovation and motivate the principals and administrators to support the innovation. The ‘Bottom-up’ approach, however, is impossible in many developing countries, because of highly centralized budgeting and bureaucratic decision making (Bishop, Clark and Grant, 1991, p.322).

2.1.1 Implementation in the Change Process

The present study focuses on the implementation process, which many authors consider a crucial part of the change, or innovation, process in education.

Some authors view innovation as consisting of only two major sub processes or stages: Initiation and Implementation (Zaltman, Duncan and Holbek, 1973; Rogers, 1983; Huberman and Miles, 1984). The Zaltman, Duncan, and Holbek (1973) model defines these stages as follows: Initiation and Implementation.

Initiation

(1) Knowledge Awareness
(2) Attitude Formation
(3) Decision

Implementation

(1) Initial Implementation
(2) Continued-Sustained Implementation

According to Holbek (1988):

Initiation is concerned with how the organization becomes aware of innovation, with the formation of attitudes toward the innovation, and with the innovation’s development towards the making of a decision about its implementation (p.253).

Other models have more stages; for example, Jacobson’s model of change (Jablonski, 1980) includes the following nine stages: (1) Formulate objectives; (2) determine feasible structure and programs; (3) establish priorities, (4) determine procedures for implementing; (5) plan time phasing; (6) implementation; (7) evaluation; (8) refinement; and (9) revision.

In Fullan’s model of change (Fullan, 1991), there are three broad phases to the change process.

Phase 1- Initiation, Mobilization, or Adoption which “consists of the process that leads up
to and includes a decision to adopt or proceed with a change” (Fullan, 1991, p.47).

Phase 2- Implementation which is the process of putting a change into practice.

Phase 3- Institutionalization, Continuation, Incorporation, Routinization, which “refers to whether the change gets built in as an ongoing part of the system or disappears by way of a decision to discard or through attrition (Fullan, 1991, p.48).

Figure 2.1: A Simplified Overview of the Change Process

As figure 2.1 (adapted from Fullan, 1991, p.48) shows, the process of innovation is not one-way linear. “Events at one phase can feed back to alter decisions made at previous stages, which then proceed to work their way through in a continuous interactive way. What happens at one stage of the change process strongly affects subsequent stages” (pp.48-49) and the outcome.

A most important stage of the innovation process is implementation. It involves all the activities that happen between “conceiving of a new idea and assimilating it into regular practice” (Bishop, Clark and Grant, 1991, p.314). In Fullan’s (1991) model of the change process in education, implementation is after initiation and before continuation. On the importance of implementation, Ely (1990) wrote: “Implementation can be seen as the last step in the portability process and all the careful efforts that have gone into designing and adapting a product will come to no result if implementation will not occur” (p.298).

According to Fullan (1993), “The term implementation was not even used in 1960s, not even contemplated as a problem...around 1970 when the first implementation studies surfaced...in Goodlad et al ’s (1970), Gross et al ’s (1971), and Sarason’s (1971) major studies of failed implementation” (Fullan, 1993, p.1). In the Gross and Bernstein (1971) literature review on educational change, they use the words “deficient”, “speculative”, and “hortative” to describe literature on the implementation process (Godlewski, 1989). According to Godlewski (1989); Jablonski (1980) and Fullan and Pomfret (1977), most of the research on innovation pertains to adoption practices rather than implementation. For example, Fullan and Pomfret (1977) report,
"Most studies and their findings deal with adoption rather than implementation" (cited by Godlewski, 1989, p.45). Further study is recommended by the researchers (Miles, 1983; Loucks and Zacchei, 1983; Jablonski, 1980, Godlewski, 1989). During the last decade, there has been more attention to the implementation process (Bishop, Clark and Grant 1991; Ely, 1990; Fullan, 1991, 1992, 1993; Fullan, Miles and Anderson, 1988).

2.1.2 Factors Affecting Success of Computer Implementation

Papert (1980) and many others (e.g. Means, 1994, Scardamalia, 1995) believe that the computer is able to transform the educational process.

The potential of computers for education is not realized unless schools can successfully incorporate the technology into their regular activities (Means, 1994; Ragsdale, 1988). The stage in which an organization attempts to incorporate technology into its daily activities is called the "implementation phase" (Bishop, Clark and Grant, 1991). According to Hall:

Change is a process and there are phases to that process. The microcomputer movement is in the first phase, called Development. An innovation is being developed. The next phase would have to do with the dissemination. With dissemination come decisions to Adopt, which lead to the implementation phase. Attempts to implement do not necessarily lead to continued stable use, this phase is referred to as Institutionalization. Many innovations went into the implementation phase and came back out again. They didn’t become institutionalized as a regular way of life (Hall, 1981, p.15).

Ely (1990) points out that implementation of innovation requires competent people and a facilitative environment to be sure that the job gets done well. According to Ely (1990) all the attempts that have been made in the design and adoption of a product would be useless if implementation did not occur.

The focus of implementation is on what occurs in practice and it is concerned with the factors and processes that influence how and what changes are achieved. According to Fullan and Hargreaves, 1992 “By investigating implementation directly we can begin to identify the reasons why innovations fail or succeed” (Fullan and Hargreaves, 1992, p.21). According to Fullan (1992), the key issue from an implementation perspective is how the process of change occurs: What people do (behaviors) and think (beliefs) in relation to a particular innovation.

Fullan, Miles and Anderson (1988) in “Strategies for Implementing Microcomputers in Schools” have considered ten factors for successfully implementing new educational technologies (NET) in Ontario’s schools (see Table 1.2 above). The following is a brief description of the factors.
2.1.2.1. Factors Related to the Characteristics of the Innovation

Clarity and Complexity: According to Fullan’s theory, for successful implementation, the implementors should have a clear idea about what they are going to do to implement the innovation. In-service teacher training, Ministry guidelines and participation in the development of the innovation could help implementors to understand the objectives and their own roles. Complexity is defined by Fullan as arising from the number of practices affected and the degree of difference from existing practices, materials and beliefs. “More complex innovations requiring major changes are harder to gain clarity about and more difficult to implement.” (Fullan, 1988, p.3.5).

Consensus/Conflict: The implementation is more successful when the people who are involved have agreed on the need of having that innovation and “on the appropriateness of the innovations selected, and on the priority of the change effort relative to other local concerns” (Fullan, 1988, p.3.20). In addition to teachers, the consensus of other groups such as administrators, principals and parents is also important in the implementation. “Obtaining general agreement or collective opinion” is also mentioned in the implementation process of Bishop’s model of innovation (cited by Godlewski, 1989, p.48).

Quality/practicality: The innovation is implemented more successfully when the outcomes and the results of the innovation are obvious to the implementors. “If the impact of the innovation is uncertain, its success may depend on careful implementation and monitoring of effects and innovation modification during implementation” (Fullan, 1988, p.3.30).

2.1.2.2 Local Conditions:

Central office direction, Support, and Commitment:

The commitment and actions of central office administrators are critical to the success of board-wide implementation efforts. General endorsement and verbal support do not suffice. Teachers and principals are unlikely to invest the effort needed if central administrators do not demonstrate with actions as well as words that they take the change seriously” (Fullan, 1988, p.3.44).

Administrative pressure should be accompanied by support and assistance. Assistance includes in-service training, consultative help and resource (material) availability. According to Eurich-Fulcer and Schofield (1995), one way in which organizations may demonstrate their commitment to computer use is by providing meaningful incentives and opportunities for teachers to engage in computer activities. Ely (1990) also considered the importance of...
incentives. He reported:

For some it may mean satisfaction for a job well done; for others it may mean more assistance, more (or better) resources, and in some cases, increased salaries and professional opportunities (Ely, 1990, p.301)

Warwick, Reimers and McGinn (1992) in a study of implementation of educational innovations in Pakistan pointed out that “The chances of implementation increase when field implementors, such as teachers and head teachers, are motivated to use an innovation” (Warwick, Reimers and McGinn, 1992, p.300).

Process for Implementation and Institutionalization: According to Fullan, Miles and Anderson (1988), having a clear organizational model with sets of procedures would help the implementation process.

Good implementation requires good planning... During the initiation phase, planning should focus on creating an organizational structure and process for the change. This includes setting realistic timelines for implementation and deciding when to introduce it to different target groups throughout the system, as well as determining strategies or such thing as acquiring and distributing materials, communicating role expectations, providing initial and follow up training, consultative assistance, monitoring and problem solving. It also means establishing a priority for the project and coordinating it with other innovation projects in the local setting...While a top-down approach can be used at the initiation stage, administrators must share control over the process with the users during the implementation” (Fullan, Miles and Anderson, 1988, p.3.51)

Professional Development and Assistance: Staff development is essential for the implementation and continuation of the educational innovations. The literature emphasizes the importance of teacher training to stimulate their computer use and to foster favorable attitudes toward computers (Aston, 1988; Boufi, 1994; Cohen, 1979; Dupagne and Krendl, 1992; Hagey, 1985; Madsen and Sebastiani, 1987; Sebastiani, 1985; Smith, 1987; Vensel, 1981; Vermette and Orr, 1986; Woolsey, 1985). According to Olson (1986), “in general, teachers acknowledge the importance of in-service training to prepare them to teach computers as a subject” (cited by Dupagne and Krendl, 1992, p.423). The more complex innovation needs more training.

The role of staff development in the success of implementation is explored by many authors (Bishop, 1976; Fullan, 1991, 1992; Gursky, 1986; Huberman and Miles 1984). Dupagne and Krendl (1992) believe that teacher training is essential. Bishop, Clark and Grant (1991), discuss education and communication as effective implementation strategies. According to Bishop, Clark and Grant (1991), two groups should be educated:
The teachers, because they ultimately determine the success or failure of the new systems; and the administrators, because they generally allocate implementation resources and motivate the staff (Bishop, Clark and Grant, 1991, p.318).

Implementation Monitoring and Problem Solving: “The success of implementation is highly dependent on the creation of effective ways of getting information about implementation progress and problems from users in the classrooms to appropriate building and central administrators and assisters”(Fullan, Miles and Anderson 1988, p.3.75).

According to Willard (1992), monitoring the progress of the change is also important during the implementation phase, both to facilitate the administrator’s job and to providing data for evaluation. According to Fullan (1992), by obtaining information about the progress of the implementation process, additional in-service and assistance, materials, support, and possible modifications in plans become possible.

Principal’s Leadership: Review of the literature indicates the critical role of the principal’s support for implementation of innovation (Fullan, 1992, McGee, 1985; Nakafuji, 1985; Olson, 1986; Sharman and Cothern, 1986; Toomey, 1987). According to Cattard (1987), principals perceived the following problematic areas in the implementation of computers in school:

(a) hiring qualified teachers, (b) allocating resources for teacher in-service training, and (c) scheduling for computer education programs (cited by Dupagne and Krendl, 1992, p.422).

However, in a centralized system of education, these types of problems are identified at the Ministry level.

Community Support: The role of community support is considered very important in the implementation of computers by many authors (Fullan, 1991, 1992; Fullan and Hargreaves, 1996; Zuk and Stilwell, 1984; Bloch and Tabachnick, 1994)

In addition to staff preparation, some community preparation may be necessary in order to ensure parental support. Most parents like to understand what their children are learning. Public support of the computing curriculum is vital if the district (or private institution) is to acquire adequate funding (Zuk and Stilwell, 1984, p.381).

Environmental Stability: Fullan, in his model of implementing computers in schools (1992), refers to environmental stability as “frequent or unexpected changes in administration and project
leadership...major shifts in government policies, alterations in implementation relevant technologies, demographic changes in student population, economic trends affecting the availability of funding, and public opinion" (p.53).

2.2 Literature Review on Computer Use in Education in Developing Countries

The purpose of this section is to review the research that has been done on computer use in education in developing countries, focusing on the use of computers and the implementation issues which were reported by researchers. Fourteen different countries [China, Egypt, India, Jordan, Kenya, Mauritius, Sri Lanka, South East Asia (Brunei, Indonesia, Malaysia, the Philippines, Singapore), Tunisia and Zimbabwe] were selected on the basis of availability of information and of the different ways in which they have applied computers in education. Information about the application of computers in these fourteen countries is taken from a comprehensive study of using computers in third world schools up to 1989 (Hawkridge, Jaworski and MaMahon, 1990) and summarized by the author in tables 2.1 to 2.4. later in this chapter. It is worth mentioning that the situation may have been changed in the last eight years. The researcher was unable to find more recent studies on computers in developing countries which deals with these issues.

2.2.1 Rationale for Computer Use in Schools

Computers are being used in schools in many different ways and for different purposes.

Educators use new technologies to support creative expression, to increase literacy, to address special needs, to develop students' problem solving skills, and to prepare youth for adult life (Egnatoff, 1992, p.195).

According to Hawkridge, Jaworski and MaMahon (1990), arguments for computer education in the schools in both the developed and developing nations can be organized under the following categories: social, vocational, pedagogical and catalytic.

Social rationale: This rationale deals with the place of students in the society. According to Witthuhn (1985), the community and parents expect schools to produce “technological literate” graduates who would be prepared to live in a world filled with computers (Witthuhn, 1985, p.27). In order to be ready to function adequately as citizens in such a society, students should be aware of and unafraid of working with computers.

Vocational rationale: According to Anderson (1986), economic development depends on young people acquiring computer knowledge and skills. Computer skills in programming and application programs enable students to function adequately as professional workers in the society (Rock, Glick and Sprout 1991).
Pedagogical rationale: Computers can be used for improving the instructional process and increasing learning (Sandholtz, Ringstaff and Dwyer 1992; Cohen, 1987).

Catalytic rationale: Computers are catalysts, enabling desired change in education to occur. By using computers, teaching, learning, administrative and managerial efficiency may be improved (Davie and Wells, 1991; Pea, 1994; Ragsdale, 1988, Scardamalia, 1992). Students may become less dependent on the teachers as experts. By using computers, students will learn through problem solving and collaboration rather than through memorization and competition (Papert, 1980, Scardamalia, 1995). Administrators improve the way they manage schools by using computers (Oliveria, 1989).

2.2.2 Educational Computer Applications in Developing Countries

Computer applications in education are categorized into 3 major areas: teaching through computers, teaching with computers, and teaching about computers (Taylor, 1980; Ragsdale, 1982, 1988). Teaching through computers occurs when the computer performs the role of a tutor, such as in computer assisted instruction. Teaching with the computer occurs when the computer is used as a tool, such as in word processing, data base management and spreadsheets (Ragsdale, 1991). Teaching about computers occurs when the computer itself is the object of study, such as in computer studies courses (Taylor, 1980).

Kurland and Kurland (1987) conducted an historical review of computer use in schools in North America. They concluded:

For over 20 years, the role of computers in education has been evolving through several distinct phases. Each phase has been marked by significant changes in hardware but has also been accompanied by a philosophic change in how computers should be employed in the educational process (p.318)

The phases are: Phase 1: Administrative Use (early 1960s); Phase 2: Computer Assisted Instruction (late 1960s); Phase 3: The Micro Invasion and the Decentralization of Computers (early 1980s); Phase 4: Logo and the Emergence of the Computer as a Tool to Think With (early 1980s); Phase 5: The Computer Literacy Movement -Schools Attempt to Regain Control (early 1980s); Phase 6: The Computer as Tool-Word Processing and Personal Productivity (early to mid 1980s); Phase 7: Incorporation of Computers into the Mainstream Curriculum (mid-1980s). It is worth mentioning that these phases often overlap or cycle with new developments and as new groups become computer users.

Sutton (1991) also pointed to this change in computer use in education during the 1980's:
By the end of the 1980s, a trend away from programming in high schools had been reported (McCarthy, 1988; Yoder, 1989), and an emphasis on using the computer as a tool (e.g., word processing, databases, graphics tools) integrated into the curriculum was evident (Becker, 1990; Brady, 1991; McCarthy, 1988) (cited by Sutton, 1991, p.481).

The focus of this section is on reviewing the applications that are most common in developing countries. The three most common uses of computers in developing countries are in these areas: computer studies courses, CAI and administrative use.

2.2.2.1 Computer Studies Courses

According to the literature review, in industrialized countries the emphasis used to be on making all students computer literate at an early age. Ragsdale (1982) pointed out that “The age level for the acquiring of computer literacy has been dropping rapidly” (p.20). Becker in his 1983 national survey of 2,209 public, private elementary and secondary schools in the United States reports:

Yet the evidence from our national survey of micro-computer-using schools is that secondary schools remain the largest pre-college users of microcomputers and that the overwhelming emphasis in secondary schools (and in the earliest computer-adopting elementary schools) is on teaching students about computers and how to program them using the BASIC language (Becker, 1983, p.29).

However, since the mid eighties, the focus has shifted from computer literacy courses to the integration of computer use within the curriculum (Ragsdale, 1988, 1994, Sheingold and Handley, 1990). Computer Studies courses are still being taught, but usually as specialized, optional courses at the secondary level. Such computer studies courses focus mainly on learning about computers, programming, as well as various computer applications (Cohen, 1997).

In developing countries, teaching computer studies courses is the most important use of computers for educational purposes (Khan and Shrama, 1985; Hawkridge, Jaworski and MaMahon 1990). Table 2.1. (information of the table is taken from Hawkridge, Jaworski and MaMahon 1990) shows that in developing countries (except for the Philippines), most computer time was devoted to computer studies courses, and as is shown, the courses were optional. In countries such as Singapore and Sri Lanka, selected students can follow a published syllabus on their own and take an Advanced Level examination developed by other agencies. The Ministries of Education in China, Jordan, Malaysia and the Philippines have laid down a syllabus for computer studies in their respective countries, but there are no examinations on this topic (Hawkridge, Jaworski and MaMahon 1990).
<table>
<thead>
<tr>
<th>Country</th>
<th>Computer Course</th>
<th>Content of Computer Course</th>
<th>School Level</th>
<th>Age</th>
<th>Gender</th>
<th>How Long (year)</th>
<th>Duration In Year</th>
<th>Compulsory</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Yes</td>
<td>Basic Principle</td>
<td>Secondary</td>
<td>16-18</td>
<td>Both</td>
<td>1</td>
<td>45-60 hours</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basic Language</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basic Operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td>Yes</td>
<td>LOGO language &amp;</td>
<td>Upper</td>
<td>15-17</td>
<td>Boys</td>
<td>1</td>
<td>68 hours</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Application &amp; Application programs</td>
<td>Secondary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>Yes</td>
<td>Content free</td>
<td>Secondary</td>
<td>15-17</td>
<td>More boys than girls</td>
<td>1</td>
<td>80 hours</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Jordan</td>
<td>Yes</td>
<td>No Information</td>
<td>Secondary</td>
<td>16</td>
<td>Both</td>
<td>1</td>
<td>60 hours</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Kenya</td>
<td>Yes</td>
<td>BASIC language &amp;</td>
<td>Secondary</td>
<td>16</td>
<td>More boys than girls</td>
<td>1</td>
<td>No Info.</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PASCAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mauritius</td>
<td>Yes</td>
<td>No Info.</td>
<td>Secondary</td>
<td>15-16</td>
<td>Both</td>
<td>2</td>
<td>50 hours</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Yes</td>
<td>BASIC, LOGO &amp;</td>
<td>Secondary</td>
<td></td>
<td>Both</td>
<td>1</td>
<td>No Info.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Graphic and Flow chart</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No Info.= No Information
### Table 2.1: Computer Education Courses in Developing Countries (14 Countries)

<table>
<thead>
<tr>
<th>Country</th>
<th>Computer Course</th>
<th>Content of Computer Course</th>
<th>School Level</th>
<th>Age</th>
<th>Gender</th>
<th>How Long (year)</th>
<th>Duration In Year</th>
<th>Compulsory</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>South-East (Brunei)</td>
<td>Yes</td>
<td>No Information</td>
<td>Upper Secondary</td>
<td>16</td>
<td>No Info.</td>
<td>No Info.</td>
<td>Discontinued</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Indonesia</td>
<td>Yes</td>
<td>BASIC</td>
<td>Secondary</td>
<td>16</td>
<td>Both</td>
<td>1</td>
<td>No Info.</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Yes</td>
<td>BASIC, LOGO &amp; Application programs</td>
<td>Secondary</td>
<td>16</td>
<td>Both</td>
<td>1</td>
<td>40 minutes (week)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Singapore</td>
<td>Yes</td>
<td>BASIC, LOGO &amp; Application programs</td>
<td>Secondary</td>
<td>16</td>
<td>Both</td>
<td>2</td>
<td>30 Min. (week)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Tunisia</td>
<td>Yes</td>
<td>BASIC, LOGO, &amp; Application programs</td>
<td>Secondary</td>
<td>15-17</td>
<td>Both</td>
<td>2</td>
<td>70 hours</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>Yes</td>
<td>BASIC, LOGO &amp; Application programs</td>
<td>Primary Secondary</td>
<td>No Info.</td>
<td>Both</td>
<td>No Info.</td>
<td>No Info.</td>
<td>No Info.</td>
<td>No Info.</td>
</tr>
</tbody>
</table>

South East Asia (Brunei, Indonesia, Malaysia, The Philippines & Singapore) are shown in the table by Italic words.

**Reference:** Hawkridge, Jaworski and MaMahon (1990)
The emphasis of all computer courses is on programming (see Table 2.1). According to Hawkridge, Jaworski and MaMahon (1990), all of these countries conceive of computer programming as a second literacy. In all of these countries the computer studies course is for secondary school students and the average age is 16 years old. In Egypt this course is for boys only, while in India and Kenya more boys participate in the computer course. The reason for this gender difference was not determined. The duration of the course differs among the different countries; the average is 57 hours in a year (Hawkridge, Jaworski and MaMahon 1990). The content of these computer studies courses depends on the objectives for establishing the course and such objectives vary among the countries. India is the only country in which the content of such courses is determined by the computer teacher.

In addition to teaching programming some teachers introduce application programs. According to Hawkridge, Jaworski and MaMahon (1990), in developing countries, application programs are in the hands of teachers of computer studies. These teachers use them in the context of computer studies, not for studying other subjects across the curriculum. Some Chinese teachers report that they often can not make use of these programs, due to insufficient hard disk space (Hawkridge, Jaworski and MaMahon 1990).

2.2.2.2 Computer Assisted Instruction (CAI)

In industrialized countries, CAI software packages are used for teaching different subjects (Bell, 1980) such as Mathematics (e.g. Kendrick, 1992, McCoy, 1996; McDougall, 1996), Economics (e.g. Hurd, 1987), Language arts (e.g., Morgan and Hosay, 1991), Social Studies (e.g. Berson, 1996; Ehman and Glenn, 1987; Kent and Lewis, 1987, Wiebe and Martin, 1995), Science (e.g. Berkowitz and Haase, 1987; Osborne, 1987, Weller, 1996), and Music (e.g. Reimer, 1989, Taylor, 1988). In addition, CAI has been used in remedial programs (e.g. Higgins and Boone, 1990 and to help students with disabilities (e.g. Fitzgerald, 1996, Higgins and Boone, 1990).

Among developing countries, as indicated in Table 2.2, China, the Philippines, Singapore, and Tunisia are the only countries that use CAI. Except for a few programs that are produced in Chinese almost all CAI programs are imported from English language countries. Most of the CAI programs used are for Mathematics, because according to Glavis (1987), mathematics programs are less affected by cultural bias.
Table 2.2: Computer Assisted Instruction (CAI) and Administrative Use

<table>
<thead>
<tr>
<th>Country</th>
<th>(CAI)</th>
<th>Subject area</th>
<th>Administrative use</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>Yes</td>
<td>Math, Science, Physics,</td>
<td>Yes</td>
<td>Little Chinese software,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electricity, Foreign Languages.</td>
<td></td>
<td>Lack of hard drive and printer.</td>
</tr>
<tr>
<td>Egypt</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Jordan</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>No</td>
<td>-</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Mauritius</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>South-East</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>(Brunei)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td>Because of language and financial problem.</td>
</tr>
<tr>
<td>Malaysia</td>
<td>No</td>
<td>-</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>The Philippines</td>
<td>Yes</td>
<td>Math, Science</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>Yes</td>
<td>Biology, Chemistry,</td>
<td>Yes</td>
<td>English problems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Earth Science, English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tunisia</td>
<td>Yes</td>
<td>Physics, English</td>
<td>Yes</td>
<td>Shortage of suitable software.</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Reference: Hawkridge, Jaworski and MaMahon (1990)
2.2.3 Administrative use

In industrialized countries, computers are used as an administrative tool for different purposes.

Among developing countries, only a few have been reported in literature on computerizing school records. This has occurred in China, Kenya, the Philippines, Singapore and Tunisia (Cerych, 1982; Hawkridge, Jaworski and MaMahon, 1990). In Kenya, only one computer is used for administration in each school. In Singapore, the administrative computers were part of a School Link project, connecting each school with the Ministry mainframe computer. According to Hawkridge (1991b), China is the only country in which computer studies teachers and their students have written programs to assist in administration.

2.3 Implementation Issues in Using Computers in Developing Countries

2.3.1 Student Access to Computers

Previous research on the introduction of computers in industrialized countries has indicated that accessibility of computers is an important determinant of use (Carmichael, et al., 1985; Cuban, 1986; Eurich -Fulcer and Schofield, 1995; Fullan, 1992; Ragsdale, 1982, 1988, 1994; Rosen and Weil, 1995; Sutton, 1991). According to Eurich -Fulcer and Schofield (1995), the number of machines per person and the location of computers are important factors affecting the computer use. Carnoy, Delay and Loop (1987), described four levels of student access to computers in industrialized countries (cited by Hawkridge, Jaworski and MaMahon, 1990) as follows:

Level 1: Students have access to a powerful microcomputer with educational software and peripheral equipment at home. According to Carnoy, Delay and Loop (1987), the three basic components (access, facilities and advice) are in good supply in the schools too.

Level 2: Students have limited access to computers such as a few hours per week with moderately good facilities and software and one trained advisor. In this case schools have good facilities.

Level 3: One of the three components (access, facilities and advice) is missing, or there is not enough of it available. In this case, even if hardware is available, there is a lack of educational software or a trained advisor.
Level 4: Many schools do not have computers; students have to travel to another school which has computers, if they want to use computers. According to Hawkridge, Jaworski and MaMahon, 1990, at the time of their study, there were very few cases of level 1 access in the developing countries. Levels 2 existed in few selected secondary schools. Level 3 was the most common case in developing countries and level 4 was not reported.

Another factor related to computer access is location. According to Chornienne (1988), three types of location modes existed in Quebec schools:

- The distributed mode (computers located in certain teachers' classrooms).
- The centralized mode (computers pooled in a central laboratory).
- The “flying mode” (computers mounted on mobile carts)” [p. 88].

Hybrids (having computers in classrooms and also in computer labs) are also common.

In developing countries the location mode is centralized, because computers are placed in special rooms, called computer laboratories or resource centers, and classes come to these rooms at allocated times. In almost all the developing countries, access to computers is usually limited to class hours, except that some schools also have computer clubs to which students can go at other times by reservation. According to Hawkridge, Jaworski and MaMahon (1990), at the time of their study, in most of the developing countries there was no equal opportunity for using computers by all, and computer education is for rich people or it is only for boys (see Tables 2.1 and 2.3). As is shown in Table 2.3, different kinds of computers are used by developing countries and this causes another problem in finding suitable software for them.

There is not much research on students’ home access to computers in developing countries. Jegede and Okebukola (1992) in their study of Nigerian schools indicated that “students with low socio-economic status are disadvantaged in their exposure to and knowledge about computers in comparison to those with high socio-economic status” (p. 332)

2.3.2 Cultural Factors in Using Computers

According to Hebenstreit (1984), students in industrialized countries learn many things about computers from experiences in their environment. For example, students have a wide experience of pushing keys and buttons in their daily life, so they would learn the keyboard more easily.
<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Name of Hardware</th>
<th>Number of Computers</th>
<th>Number of Schools with Com.</th>
<th>Obtained by</th>
<th>Software Kind and Source</th>
<th>Language of Software</th>
<th>Official Language</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1987</td>
<td>64K (CEC), COMX-35, Apple II, Grant Wall. 5020 &amp; LAMBD 8300</td>
<td>17,000</td>
<td>1000</td>
<td>Donation, Manufactured by Themselves</td>
<td>Wordstar, dBase III &amp; Lotus 1-2-3 No information</td>
<td>English &amp; Chinese</td>
<td>Chinese</td>
<td>Access was limited to the class hours, costs of use, repair and replacement &amp; shortage of paper.......</td>
</tr>
<tr>
<td>Egypt</td>
<td>1987</td>
<td>Sinclair, Acorn, IBM &amp; Sakher MSX.</td>
<td>50</td>
<td>25</td>
<td>Donation by French</td>
<td>No Information</td>
<td>No Info.</td>
<td>Arabic</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>1985</td>
<td>BBC 32K, Acorn, &amp; Unicorn</td>
<td>900</td>
<td>250</td>
<td>Gifted(Queen), Made by Them</td>
<td>Application P. UK donation</td>
<td>English</td>
<td>Regional Language</td>
<td>Problems in handling software in English</td>
</tr>
<tr>
<td>Jordan</td>
<td>1984</td>
<td>Apple II e, Sakhar &amp; Akhtar</td>
<td>20</td>
<td>2</td>
<td>No Information</td>
<td>Application P. Import(British)</td>
<td>English</td>
<td>Arabic</td>
<td>No methodology for selecting and obtaining &amp; translating software</td>
</tr>
<tr>
<td></td>
<td>1988</td>
<td></td>
<td></td>
<td>2000</td>
<td>160</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kenya</td>
<td>1986</td>
<td>Apple II c, Spectrum &amp; BBC-B</td>
<td>403</td>
<td>No. Info.</td>
<td>Donors Agencies and Apple company</td>
<td>Application P. Donation (Apple company)</td>
<td>English</td>
<td>English</td>
<td>Due to lack of suitable software, some computers are useless.</td>
</tr>
</tbody>
</table>

Application P. = Application programs  
Com. = Computer  
Info. = Information
<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Name of Hardware</th>
<th>Number of Computers</th>
<th>Number of Schools with Com.</th>
<th>Hardware Obtained by</th>
<th>Software Kind and Source</th>
<th>Language of Software</th>
<th>Official Language</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mauritius</td>
<td>1982</td>
<td>IBM, Commodore &amp; PCs</td>
<td>32</td>
<td>11</td>
<td>French Government, JVC House</td>
<td>No Information</td>
<td>No Information</td>
<td>No Information</td>
<td>No centrally mediated software provision. Teacher borrow software from each other.</td>
</tr>
<tr>
<td>South-East Asia- Brunei</td>
<td>1984</td>
<td>BBC-B.</td>
<td>13</td>
<td>55</td>
<td>Donation by Brunei Shell Petroleum Company</td>
<td>No Information</td>
<td>No Info.</td>
<td>No Info.</td>
<td>No centrally mediated software provision. Teacher borrow software from each other.</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1982</td>
<td>Apple II, &amp; PC Compatible</td>
<td>No Info.</td>
<td>33</td>
<td>Government and Parent-Teacher-Association</td>
<td>Application P.</td>
<td>English</td>
<td>Bahasa</td>
<td>No centrally mediated software provision. Teacher borrow software from each other.</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1986</td>
<td>Apple, IBM &amp; NEC.</td>
<td>100</td>
<td>20</td>
<td>Government &amp; Revenue of Computer Club</td>
<td>Application P.</td>
<td>English</td>
<td>Bahasa, Malaysian &amp; Chinese</td>
<td>No centrally mediated software provision. Teacher borrow software from each other.</td>
</tr>
</tbody>
</table>
Table 3.3: State of Hardware and Software in Developing Countries (14 Countries)

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Name of Hardware</th>
<th>Number of Computers</th>
<th>Number of Schools with Com.</th>
<th>Hardware Obtained by</th>
<th>Software Kind and Source</th>
<th>Language of software</th>
<th>Official Language</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Philippines</td>
<td>1986</td>
<td>120 Different model %70 USA, %17 Japanese &amp; %13 others</td>
<td>165</td>
<td>24</td>
<td>Japanese Donation &amp; Parent Teacher Association</td>
<td>Application P. Imported</td>
<td>English</td>
<td>No Info.</td>
<td>No Info.</td>
</tr>
<tr>
<td>Singapore</td>
<td>1981</td>
<td>No. Information</td>
<td>451</td>
<td>41</td>
<td>No Information</td>
<td>Application P. No Information</td>
<td>No Info.</td>
<td>No Info.</td>
<td>No Info.</td>
</tr>
</tbody>
</table>

Reference: Hawkridge, Jaworski and MaMahon (1990)
One important cultural factor that should be considered in the implementation of computers in developing countries is language. According to Venter and Blignaut (1996), in a study of South African schools, “Language ability was identified as being the most important factor contributing to the success rate of students” in the computer literacy course (p. 28). According to Hawkridge, Jaworski and MaMahon (1990, language is a big problem in countries such as Tunisia where students have to use English software in spite of the fact that the first and second languages in this country are Arabic and French (see Table 2.3). In China attempts have been made to introduce computers that can deal with Chinese characters (Hawkridge, 1990).

According to Hawkridge, Jaworski and MaMahon (1990), most developing countries do not use imported programs because of the cultural bias inherent in the software. “Yet there is virtually no educational software written and published in the third world” (Hawkridge, Jaworski and MaMahon, 1990. p.251). The culture of software imported from industrialized countries is quite different from that of developing countries and according to Galvis (1987), educational technology transfer can be a path for amplifying the cross cultural diffusion processes, which may weaken local cultures. According to Friend (1987), most US software programs are not accepted by the Ministries of Education in the developing countries due to cultural differences.

Galvis (1987) suggested that mathematics programs are less affected by cultural biases, as the only cultural difference is in the way in which math is taught. National culture, beliefs, values, and traditions are also important factors in using computers in developing countries (Akinyemi, 1989). “A common stereotype in Africa is the association of men with technology and women with domiciliary affairs (kitchen)” (Akinyemi, 1989, p.267). The role and activities of women in many developing countries have been severely restricted in the past.

Research in industrialized countries also indicate that “computing is stereotyped as a male domain” (Sutton, 1991, cited by Eurich -Fulcer and Schofield, 1995). “The culture surrounding a group of people is a factor that is usually assumed to have a strong effect on how people form personal beliefs, which in turn determines attitudes towards an object, action or event” (Makrakis, 1992, p. 276). Moreover, male students have substantially more computer experience outside of the classroom than females (Eurich-Fulcer and Schofield, 1995; Sutton, 1991; Hess and Miura, 1985). According to Sutton (1991), the only area in which girls outnumbered the boys was in word processing (Nathan and Baron, 1995). Similar gender inequities have also been reported by other authors (Collis, Kass and Kieren, 1989; Nathan and Baron, 1995; Ragsdale, 1994).
The factors underlying these gender differences frequently suggest that socio-cultural expectations for males and females differ and that these differing expectations explain gender-related differences in attitudes towards computers (Miura & Hess, 1983; Collis & Williams, 1987). In general, gender differentiation is a product of the social construction that determines what models of correct behavior are given to children of each gender (Turkle, 1984). In connection to that, differences with respect to the amount of student encouragement towards educational computing exerted by parents and teachers may have an influence on the way certain attitudes towards computers are developed (cited by Makrakis, 1992, p.276).

2.3.3 Principals’ Roles and Attitudes toward Computers

According to Warwick, Reimers and McGinn (1992) managers and implementers, such as school heads and teachers, should know what they are expected to do and have the means necessary to act. According to Fullan (1991), implementation is most likely to be successful when those directly responsible for carrying out an innovation understand its purposes and do what is necessary to make it happen. Implementation is least likely when implementers do not understand what they are expected to do.

The basic question that principals need to address is, why should computers be used in the classroom? “There should be a sounder rationale than deciding to go into computers simply because other schools are doing it” (Bishop, Clark and Grant, 1991, p.23).

There is no comprehensive research about the knowledge of principals in developing countries, but it can be inferred from the literature; lack of knowledge on the part of principals is one of most serious obstacles to the use of computers in developing countries (Hawkridge, Jaworski and MaMahon, 1990). For instance, in Jordan many principals have negative attitudes to computers due to a lack of knowledge about the potential use of computers in education.

In Indonesia principals had high expectations concerning computers (Hawkridge, Jaworski and MaMahon, 1990). They thought that computers:
(1) Enhance students’ learning.
(2) Keep them abreast of technological development.
(3) Enable them to obtain jobs later.

In Malaysian schools, principals were enthusiastic about computers and allocated additional time for computer classes out of school hours. Yet, according to Hawkridge, Jaworski and MaMahon (1990), the principals suffered from inadequate knowledge about computers.
2.3.4 Teachers’ Roles

In general, teachers in developing countries depend on textbooks and they expect to be regarded as authoritative sources of knowledge (Ruskin, 1986). Their traditional authority is based on discipline and classroom control. “Keeping the class quiet” is important to them. According to Ruskin (1986), working collaboratively is very rare in the classroom. As far as computer courses concerned, some of the teachers in Kenya feel that classes get too noisy when students are working on computers (Hawkridge, Jaworski and MaMahon 1990).

Because computers are very expensive in these countries, teachers fear that students will damage them. This fear is communicated to students, and can seriously inhibit the use of the machines. It can also cause teachers to exercise very tight control over classroom events when computers are involved (Wray and Wellington, 1985).

In the developing countries the most important educational goal is success in exams. Anything that affects this goal in a negative way should be avoided. Most of the teachers in developing countries are seriously concerned about whether or not the work of their students is according to the syllabus upon which the exams are based. Teachers of computer studies in China think they have low status because their subject area does not have a university entrance exam (Hawkridge, Jaworski and MaMahon 1990).

2.3.4.1 Teachers’ Views about Computers.

As in industrialized countries, teachers in developing countries differ from each other in their attitudes toward computers. According to Hawkridge, Jaworski and MaMahon (1990), teachers in Zhejiang (China) believed that money should be spent on items such as scientific apparatus, instead of wasting resources on a non-examination subject. One of the Zimbabwean teachers said that “almost all his colleagues do not see the relevance of computers to their work because they teach in schools with no computers” (Hawkridge, Jaworski and MaMahon, 1990, p.181).

Bliss, Chandra and Cox (1986) studied teachers’ attitudes in a British school, and considered seven different types of teachers:

- Favorable teachers were impressed and enthusiastic; critical ones said they were positive about computers but critical of how they should be used; worried ones were positive but worried about using them; unfavorable ones held negative views about them; antagonistic ones said they were insecure about, very afraid of or against computers; indifferent ones were non-committal and uninitiated ones said they had no perception of or ideas about using computers in school (Bliss, Chandra and Cox, 1986, p.50).
Using the above categories, Hawkridge, Jaworski and MaMahon, (1990) found that teachers who teach computers were ‘favorable, critical and worried’. Their colleagues would be categorized as ‘unfavorable, antagonistic, indifferent and uninitiated’.

According to research by Rwegayura (1988), Tanzanian teachers who taught computer courses at school had positive attitudes toward computers, but they were worried about the resistance of their other colleagues who did not use computers. The reasons for the opposition were as follows:

Pressure to finish the syllabus was great. According to research (Hawkridge, 1991; Rwegayura, 1988; Marshall, 1984), in all of the developing countries that were studied, the pressure on teachers was to finish the syllabus and any activity outside of the syllabus was rejected by students and their parents. Under such conditions, teachers of computer studies said that "they feel alienated" (Rwegayura, 1988, p.72).

According to Ng (1989), many of the Malaysian teachers were not happy about staying after school to supervise computer clubs nor did they like being faced with problems arising from hardware breakdowns, which they were seldom qualified to remedy (Peng, 1982). Zimbabwean teachers feared computers breaking down and being affected by dust and humidity (Hawkridge, Jaworski and MaMahon 1990).

According to Mares (1984), research on teachers who use computers in the teaching of other subjects in developing countries shows that there were some similarities among the attitudes of these teachers and their colleagues in industrialized countries (cited in Bishop, Clark and Grant, 1991). On the positive side:

- Teachers like the speed and positive effect in using computers to teach difficult concepts.
- By using computers, students show increased motivation for learning.

On the negative side, the quality of educational software was criticized by teachers from the cultural viewpoint (see previous discussions in section 'Cultural Factors in Using Computers). Another problem is that the teachers were not sure that using computers involves serious learning. Most of the teachers “complain about organizational and technical difficulties in using computers, especially in large classes” (Bishop, Clark and Grant, 1991, p.101).

According to Jacobsen (1987), generally teachers in developing countries have a mixture of responses to computers ranging from the positive, through indifferent to the negative. Teachers in Jordan believe that implementation of computers will be successful when the
software is available in Arabic and it is inexpensive and related to the curriculum. (Hawkridge, Jaworski and MaMahon 1990). In the Philippines, teachers were generally reported to be favorably disposed toward computer studies, but some feared the loss of their jobs and thought computers were difficult to understand (Muller and Rayfield, 1977).

### 2.3.4.2 Teacher Training in Developing Countries

Many studies of computer education have shown that the level of teachers’ familiarity with the hardware and software is a major factor in the success or failure of innovation (Bliss, Chandra and Cox, 1986; Callister JR and Burbules, 1990; Ely, 1990; Greenlaw, 1993; Harrington, 1993; Heywood and Norman, 1988). Educational technology experts believe that one barrier in implementing computers has been a lack of appropriate training for teachers (Griffin, 1987; Persky, 1990). The lack of teacher training is more obvious in developing countries. According to Marshall, “with possibly 50% or more of their teaching population having no training at all, many developing areas have a considerable way to go before in-service in the instructional application of computers makes sense” (Marshall, 1984, p. 380)

According to Fullan and Hargreaves (1992), the implementation of change in education is influenced by teachers’ ideologies (beliefs and values), “the body of ideas which they hold about education, teaching, the school process in particular, and life in general” (p. 38).

It is recognized that not all teachers are able or willing to adopt new teaching practices. The extent to which particular teaching practices are adopted and retained over a long period will depend on the educational beliefs and attitudes of teachers, the types of teaching practices they already use, and contextual factors, such as class size and classroom arrangements (Churchill, Ragsdale and Russell 1980, p. 4).

Fullan (1982) points out the need for in-service work during implementation in order to provide the “ongoing, interactive, cumulative learning necessary to develop new conceptions, skills, and behaviors” (p. 66).

According to Becker (1985), it is easier to install equipment and programs than to train the teachers to use the equipment. Different experiences show (Williams and Williams, 1984) that the most successful implementations put teacher training first, consideration of suitable courseware second, and selection of machines third. In other words, the order is, people before programs, then programs before machines.

The important factor of teacher training is often neglected by most of the developing countries. The limited training provided for some grade 10-11 teachers in Jamaica (Hawkridge,
Jaworski and MaMahon (1990) prior to implementation never addressed the question of the teachers' conception of their role. Most Jamaican teachers did not feel that they were teaching unless "they are seen to be in control of the class, dominating it with 'chalk and talk'" (Bennett and Kalman, 1980, p. 179). The use of computers requires teachers to take on a different role, that is to become facilitators (Carey, 1993; Means, 1994; Orton, 1996; Ragsdale, 1988; See, 1994).

According to Hawkridge, Jaworski and MaMahon, (1990, p. 282), "Almost all teachers using computers in developing countries were never trained to do so during their initial training, and they have had only the briefest of in-service courses relating to computers". In particular Chinese computer teachers felt that they had not received enough training to do their jobs properly. There are however, exceptions (see Table 2.4). In some developing countries such as Singapore, a 100 hour in-service course is provided for computer teachers. In Thailand a 90 hour in-service course is provided, but teachers must take further short courses afterwards (Pak and Punyapinyophol, 1987).

A major point is that as seen in Table 2.4 most of the teacher education in computing was provided directly by equipment vendors or through grants by vendors to educational institutions which were prepared to promote the educational use of computers.

2.3.5 Students' Attitudes toward Computers

Most studies indicate that the attitudes of students in many developing countries tend to be very positive (Datta, 1987, Hawkridge, Jaworski and MaMahon, 1990; Nissen, 1988; Wali, 1983). They enjoy the practical work with computers. In Tunisia, the students see knowledge of computers as essential to their careers, for which they have high expectations, being members of an elite. "One teacher says, many of the students would attend a computing club everyday if it were possible" (Hawkridge, Jaworski and MaMahon, 1990). Teachers in Zimbabwe, believed that the future of computing in developing countries may lie with students (Hawkridge, 1991) many of whom would soon know more than their teachers.

In Jegede and Okebukola's (1991) survey of Nigerian schools, the results are as follows:

(1) Students welcome and are enthusiastic about computers.

(2) The attitudes of students differ significantly on the basis of their socio-economic status and the presence of computers in the home but do not differ by gender.
Table 2.4: Teacher Training in Fourteen Developing Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Teachers</th>
<th>Teacher's Specialization</th>
<th>In-Service Training</th>
<th>How Long</th>
<th>Pre-Service Training</th>
<th>Training By</th>
<th>Miscellaneous Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>100</td>
<td>Math, Physics</td>
<td>Yes</td>
<td>Two</td>
<td>Yes</td>
<td>Teachers' College &amp; BEB Bureau</td>
<td>In addition to the teachers of Computer courses, some teachers from 3 Handicapped Schools were trained, too.</td>
</tr>
<tr>
<td>India</td>
<td>25</td>
<td>Masters degree</td>
<td>Yes</td>
<td>No Info.</td>
<td>No</td>
<td>Resource Center of UK Institute</td>
<td></td>
</tr>
<tr>
<td>Jordan</td>
<td>162</td>
<td>No Info.</td>
<td>Yes</td>
<td>3 months</td>
<td>No</td>
<td>Teacher Education Division in UK., &amp; University</td>
<td></td>
</tr>
</tbody>
</table>

Com. = Computer  Edu. = Education  No Info. = No Information
Table 2.4: Teacher Training in Fourteen Developing Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Teachers</th>
<th>Teacher's Specialization</th>
<th>In-Service Training</th>
<th>How Long</th>
<th>Pre-Service Training</th>
<th>Training By</th>
<th>Miscellaneous Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kenya</td>
<td>All of teachers for pilot study</td>
<td>Diploma in Information Technology</td>
<td>Yes</td>
<td>No Info.</td>
<td>No</td>
<td>Doner agencies, University of Nairobi</td>
<td>Teachers should have Diploma in Information Tech.</td>
</tr>
<tr>
<td>Mauritius</td>
<td>20</td>
<td>Math, Physics</td>
<td>Yes</td>
<td>3 days and 4 month</td>
<td>No</td>
<td>By themselves, Institute of Edu.</td>
<td></td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>180</td>
<td>All subjects</td>
<td>Yes</td>
<td>2 months</td>
<td>No</td>
<td>University of Colombia and Supplier of Commodere Company.</td>
<td>For teaching computer course, teachers were selected by Appitude test.</td>
</tr>
<tr>
<td>South-East (Brunei)</td>
<td>No Info.</td>
<td>Math</td>
<td>Yes</td>
<td>Short training course by Shell Com.</td>
<td>No</td>
<td>Self study and by Brunei Shell Com.</td>
<td>Insufficient number of trained staff caused the teaching of the computer course to end.</td>
</tr>
<tr>
<td>Country</td>
<td>Number of Teachers</td>
<td>Teacher's Specialization</td>
<td>In-Service Training</td>
<td>How Long</td>
<td>Pre-Service Training</td>
<td>Training By</td>
<td>Miscellaneous Information</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------------</td>
<td>--------------------------</td>
<td>---------------------</td>
<td>----------</td>
<td>----------------------</td>
<td>---------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Indonesia</td>
<td>No Info.</td>
<td>Math, Science</td>
<td>No</td>
<td>_</td>
<td>No</td>
<td>Jakarta Teachers' College + University</td>
<td>In 1983, The Jakarta Teachers' college produced a version of BASIC in Bahasa called KILANG</td>
</tr>
<tr>
<td>Malaysia</td>
<td>No Info.</td>
<td>No Info.</td>
<td>Yes</td>
<td>3 months</td>
<td>No</td>
<td>RECSAM + University</td>
<td></td>
</tr>
<tr>
<td>The Philippines</td>
<td>23</td>
<td>Math, Science</td>
<td>No Info.</td>
<td>No Info.</td>
<td>No</td>
<td>No Information</td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>1300</td>
<td>Math, Science, English</td>
<td>Yes</td>
<td>100 hours and one full year</td>
<td>Yes</td>
<td>CDIS. and National University</td>
<td></td>
</tr>
</tbody>
</table>
Table 2.4: Teacher Training in Fourteen Developing countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Teachers</th>
<th>Teacher's Specialization</th>
<th>In-Service Training</th>
<th>How Long</th>
<th>Pre-Service Training</th>
<th>Training By</th>
<th>Miscellaneous Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tunisia</td>
<td>No Info.</td>
<td>Math</td>
<td>No Info.</td>
<td>No Info.</td>
<td>No</td>
<td>Computer Science Department</td>
<td>Computer Science graduates teach computer course</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>No Info.</td>
<td>No Info.</td>
<td>Yes</td>
<td>Short workshops</td>
<td>No</td>
<td>Self study and short workshops by University</td>
<td>Few cases of breaking computers.</td>
</tr>
</tbody>
</table>

Reference: Hawkridge, Jaworski and MaMahon (1990)
According to Hawkridge, Jaworski and MaMahon (1990), students from China like computers, some are fascinated by them and stay after school. Chinese boys are more interested in them than Chinese girls, especially in programming. Most of the top students are boys. Boys tend to win the prizes in computer competitions. Girls are more careful; the boys are more imaginative and creative, and are more involved with computers.

In Singapore, when first introduced to computers all students were curious, enthusiastic and motivated to learn computing (Hawkridge, 1990a). After some time, the curiosity evaporated, and they believed that programming was more difficult than they had expected. In Tunisia, students who attended a pilot study had high expectations of learning with computers and they perceived that the knowledge of computers was essential for their lives (Rwegayura, 1988).

In a study by Akinyemi (1986), based on three case studies of developing countries (Nigeria, Morocco, and Argentina), he concluded:

The lessons learnt from these experiences revealed that children in these countries were enthusiastic and receptive to the introduction of micros in schools. Also four needs were established: (1) Program expansion to accommodate more children, (2) subtle approach and systematic introduction and diffusion as opposed to a governmental imposition of micros on teachers, (3) organizational/national literacy campaign on the new technologies, and (4) a general review of teacher education curricula to include elements of the new technologies (Akinyemi, 1986, p.173)

2.3.6 Parents’ Attitudes toward Using Computers in School

Parents vary in their views about using computers in the schools for their children. Their views depend on their familiarity with computers and their knowledge and expectations of computers (Hawkridge, Jaworski and MaMahon 1990; Nissen,1988; Wali, 1983). “A few parents had any information or experience with computers” (Hawkridge, Jaworski and MaMahon 1990. p.294).

According to Hawkridge (1990b), some Chinese parents did not want their children to spend time and energy on computers. Others wanted their children to study computers in depth, because they thought that if they learned to use computers, they would obtain computer related jobs in banks, or other places that are equipped with computers. Few parents help schools to develop software. Wealthier parents were considering buying computers suitable for educational use.
According to Rwegayura (1988), parents in Tunisia thought that money spent on buying computers was useless, because there was no exam in computer studies course. In the Philippines, many parents believe that when their children are at school it is up to the teachers to decide what their children should learn (Pink and Hyde, 1992). In Kenya, “some parents are worried when they find their children becoming too engrossed, and they ask teachers to dissuade them from continuing, particularly in the last year at school, before the national university entrance examination” (Molnar, 1981, p.27).

According to Muller and Rayfield (1977), despite the fact that many parents in developing countries had little knowledge of computers, they were supportive of the innovation. Hawkridge, Jaworski and MaMahon (1990) reported that in a survey of schools in Jordan, the mothers positively responded to the invitation to come to class and to see the computers in use. In Zimbabwe (Takawira, 1988), wealthier parents showed support for their children’s education by purchasing computers for home use. In Egypt, although few parents had first hand experience with computers, they wanted their children to learn about them, and showed increasing interest each year, especially when they had older children (Jedede and Okebukola, 1991). In Thailand, some rich parents donated money to Parent Teacher Associations to buy and maintain computers for their schools (Hawkridge, Jaworski and MaMahon 1990).

2.3.7 Summary of Literature Review on Computers in Education in Developing Countries

The review of literature indicates that the most important educational use of computers was for teaching courses in computer studies at the secondary level. The emphasis of these courses was on computer literacy and programming. Only a few developing countries had used computers for administrative and CAI purposes. Most of the CAI programs were imported from English language countries. In almost all developing countries, access to computers was limited to class hours, and there was no equal opportunity for using computers by all. Students with higher level of socio-economic status had more access to computers. Gender differences were also found in relation to opportunity for using computers by students. Unfortunately, this inequity in computer access also exists in industrialized countries. The literature review on implementation issues related to educational computer use in developing countries reveals a litany of resource shortages:

- There is not enough hardware.
- There is not enough software relevant to the curriculum.
- There is little culturally suitable software.
- There is little budget for maintenance and repair of computers.
- There is not enough in-service training provided for principals and teachers.
• There are no trained teachers who learned how to use computers during their pre-service training (Cory, 1984).
• There is not enough money available at the outset to purchase all of the materials that will ultimately be needed for full computer utilization.

According to Bishop, Clark and Grant (1991), purchasing of hardware and system related software will not result in computer use. The development, or selection and acquisition of software is a much more crucial, and often also more expensive part of the total process than is the purchasing of equipment. According to the literature (Hawkridge, 1990a; Hveen, 1973; Jedege & Okebukola, 1991; Nissen, 1988; Peng, 1982;) little software is acquired in developing countries for two reasons. First of all, available money is spent mainly on hardware, and second, it is felt that just having computers will cause children to be computer literate. The role of educational software is not understood (Oliver, 1993). Educational software that is acquired can be characterized as being anything that is cheap or free (Plomp & Carleer, 1987). Most software acquired is in English and/or is culturally inadequate.

In developing countries, despite the desire of governments to adopt computers in the schools, many barriers remain, such as heavy customs payments on imported hardware and software (Hawkridge, 1991a). Another issue is that when foreign manufacturers succeed in supplying computers to developing countries, as donations or at discounted prices, these same manufacturers and their local agents show little interest in after-sales support. To provide these facilities the question of funding is a critical one (Hawkridge, Jaworski and MaMahon 1990). Furthermore, provision for maintenance, safety and service also affect the availability of computer facilities.

According to a survey by Stevens (1984), computers fail in classroom instruction because of (1) hardware related issues; (2) software limitation; (3) teachers' attitudes and lack of skills in implementing instructional computing, and (4) principals who do not effectively manage the change process necessary for implementation of computers in classroom instruction. Teacher training is probably the greatest bottleneck to the successful implementation of computers in education. According to the literature, at the center are teachers who frequently find themselves with the primary responsibility for executing the implementation of computers in the classroom (Carey and Carey, 1984; Dalten, 1989). One problem in almost all of the developing countries was inadequate teacher training strategies. Only the teachers who taught computer courses received training; others have not received any computer training.
As will be shown in the following chapters, many of the same issues discussed above are also relevant to the implementation of computer use in the Iranian education system.
This chapter describes the design and the local context of the study. It first explains the procedure for getting permission for data collection; then it describes the procedures for selecting participants. Subsequent sections describe the instruments of data collection. The chapter ends with the procedure of data analysis.

3.1 Research Design

The study investigated computer use in the high schools of one Iranian city, namely Isfahan. Isfahan was chosen because, after Tehran, it is one of the biggest cities in Iran, with both an important industrial sector and an agricultural hinterland. People of different social status, both rich and poor, live there. Although there are high rise buildings in this city, there are also single family homes similar to those in Iranian urban areas. The population of this city is about 2.5 million. Thus, Isfahan provides a cross-section of the Iranian population and living conditions.

In addition, the researcher herself is a native of Isfahan and a former producer of educational TV programs for Isfahan Broadcasting. She is well acquainted with the educational situation there.

In this study, school use of computers is studied from the viewpoints of all the major participants (Borg and Gall, 1983, p.488). The data are pulled together to "provide a depth that can contribute significantly to understand the event being studied"(Borg and Gall 1983, p.488). One important approach to strengthen a research is triangulation, "or the combination of methodologies in the study of the same phenomena or programs" (Patton, 1990, p.187). This study used a triangulation of methods "to provide cross-data validity checks" (Patton, 1990, p.188) by using both qualitative and quantitative methods. Furthermore, the literature review indicates that in studying social phenomena such as education, the simultaneous application of quantitative and qualitative methods (Cook and Reichhardt, 1979; Miles and Huberman, 1984; Patton, 1990; Yin, 1984) is preferred.
3.2 Data Collection

3.2.1 Obtaining Permission

In order to collect the data, the first major concern was gaining access to the educational system. The researcher followed the "top down manner" suggested by Strauss and Schatzman in 1979 (cited by Sullivan, Olson and Logan, 1987, p.53). Using this approach, the researcher sought permission for data collection in the schools from each successive administrative level. She explained the research objectives and techniques for gathering data. The researcher commenced this process by gaining approval from the Ministry of Education, from the head of the Department of Research and Educational Planning in Tehran. He discussed the research proposal, explained the procedure for obtaining further permissions, suggested meeting the members of the Computer Group, and asked to be given the results of the research.

The next step was a meeting with the Computer Group experts, who were very cooperative and gave the researcher access to archival documents as well as to the information about how and why the Computer Studies course was first established in the curriculum, the Ministry's publications, and all regulations and circular correspondence related to the Computer Studies course. One senior expert submitted copies of documents related to the meetings of the computer committee. During the researcher's stay in Tehran, she reviewed archival documents, and arranged two interviews with the policy makers in the Ministry of Education and one interview with the head of the Computer Group. The remaining interviews were postponed to the summer, as data collection in the schools had to be completed before the summer vacation.

3.2.2 Gaining Access to the Districts.

To gain access to the high schools, the researcher followed two approaches:

First, the researcher was brought up to date on relevant changes in the management of the Isfahan Board of Education and introduced to its members by a former colleague from the TV station. Second, a letter requesting administrative consent was sent to the head of the Education Department of Isfahan University describing the researcher's current status as a graduate student and future status as a faculty member, providing information about the research proposal, defining the research procedures, and requesting a formal introductory letter to the Isfahan Board of Education. This letter was submitted to the head of Isfahan Board of Education who referred it to the Bureau of Research and Planning in the Board of Education.

The researcher explained the research objectives, defined the research methods and promised to preserve confidentiality and ethical considerations and not disrupt school routines.
To avoid the difficulty of access by the (female) researcher to boy's high schools, it was agreed that the researcher's husband would conduct these interviews if necessary. The director of the Bureau of Research and Planning introduced the researcher to the various school districts of Isfahan by a letter, and asked the Archival Department for cooperation. The researcher obtained statistical information about the Isfahan schools through the Department of Statistics and Information. Copying documents was not allowed but taking notes was acceptable.

3.2.3 Entry to the Schools (Gaining District Permission)

To obtain more information about computer use in the high schools and also to gain permission to collect data from the high schools the researcher had to go to each of the five districts separately. One of these districts was piloting the new educational reforms that were mentioned in Chapter One.

In order to gain permission for data collection in the high schools, the researcher first introduced herself and her planned study to the superintendent of each district. Then she showed them the letter from the Board of Education. All of the district superintendents signed their respective letters and then referred them to the associate superintendent in the Intermediate Education affairs. Three of the associate superintendents asked to see the questionnaires and interview guidelines and asked many questions about the proposal and the research purposes. Two of the associate superintendents introduced the researcher to the supervisor of the KAD (an apprenticeship course which students could take during high school).

The researcher was eager to know more about use of computers in the educational system and used any opportunity to obtain additional information from superintendents as well as other people in the districts. After interviewing all of the five associate superintendents of the districts, a list of the high schools and statistical information about each district was gathered.

3.3 Pilot Study

In order to examine the data collection instruments, a pilot study was done with a small sample of the participants. Earlier versions of the questionnaires described later in this Chapter were given to a small sample of the principals, teachers, students and their parents. The researcher also conducted observations in the computer labs of one boys' high school and one girls' high school.

After gathering the initial data about computer use in each district, one of the districts was omitted for sampling purposes because that district was piloting the New Educational Reform (in
the New Educational reform, the curriculum, including that of the Computer Studies course, is very different from the curriculum in the current educational system. A list of all different high schools which had a Math and Physics branch, from four different districts in Isfahan, was produced in alphabetical order by the researcher, based on the data obtained from the district superintENDENTS.

Two high schools, one of boys and one of girls, were chosen randomly for a pilot study. The related associate superintENDENTS were visited by the researcher and asked to introduce her to those two selected high schools. The associate superintENDENTS called the high schools and after introducing the researcher and the research topic asked them to cooperate with the researcher. The researcher called the principals and scheduled the meeting. The principal’s questionnaire was submitted to the principals. After meeting the principals, interviews were conducted with the computer lab managers and computer teachers of these two selected schools. Thirty students in the Computer Studies course (fifteen girls and fifteen boys) were chosen to fill out the questionnaires. These students were given students’ and parents’ questionnaires to fill out and return one week later to the researcher. The teacher’s questionnaires were submitted to the two computer teachers. Ten teachers of other subjects were also chosen to fill out the teacher questionnaire. The researcher requested that if the participants had any questions or problems related to understanding the question, not to complete that question but ask the researcher to explain during collection of the questionnaires in the following week. All participants were assured that the questionnaires would be confidential. The questionnaires were collected, ten days later, by the researcher.

All students, computer teachers and principals returned the completed questionnaires. Only 3 parents (10%) completed and returned the questionnaires. The reasons for the low rate of return from parents were their lack of knowledge about computers, or illiteracy. Of the parents who did not answer the questionnaires, five were selected randomly to be interviewed. Their children were also interviewed by the researcher. Of teachers of other subjects, 80% returned the questionnaires, but they only responded to the demographic information. In the follow-up interview, they gave different reasons for why they did not fill out all questions in the questionnaire. Most teachers of other subjects said that they did not have enough knowledge to fill out the questionnaire.

According to the results of this pilot study, the interview guides and questionnaires were revised and detailed plans were made for the main research. The researcher omitted the questionnaires for the parents and for teachers of other subjects, and replaced them with interviews because of the low rate of return. On the whole, all of the data collection methods were examined and essential changes were made.
3.4 Main Study

3.4.1 Participants

Participants in this study were a sample of the policy makers who were involved in the computer education program, the experts in the Computer Group, and samples of principals, Computer Studies teachers, teachers from other subjects, students, their parents, and computer lab managers.

3.4.1.1 Sampling

Seven of the educators who had been involved in the process of planning and decision making for computer education in Iran were introduced to the researcher by the Computer Group in Tehran for interview. More detailed information about this group will come later in this Chapter.

For gathering information from the principals, computer lab managers, teachers, students and parents, a sample of thirty high schools of four districts which had a Math and Physics branch, was selected randomly from the list of high schools which was provided for the pilot study. All principals from the thirty high schools were each given a questionnaire. According to their responses to the questionnaires and their interest in participating in an interview, sixteen of them, representing public, private and exemplar public high schools were also interviewed. All public computer labs in these four districts and a sample of two private schools from each gender were observed. All seventeen of the computer teachers from the thirty schools were also given the questionnaire to fill out. It is worth mentioning that in Iranian high schools, teachers have to work 24 hours a week, so most teachers in this study have been working in more than one school. Fifteen of the computer teachers were also interviewed according to their interests.

From the student list of 30 high schools, 250 students were selected randomly to complete the questionnaires. For choosing students, at first a list of grade 11 Math and Physics students was obtained from each of the thirty high schools. A separate alphabetical list of students by gender was drawn up by the researcher. According to their response to the questionnaires and their interest in participating in the interview, 35 students were interviewed. 25 of the students' parents were also selected randomly from the 250 students, and they were subsequently interviewed.

Focus interviews were arranged with the teachers from other subjects to obtain
information about the use of computers in other majors. For this purpose, one school from each gender was selected randomly. Eight teachers from different subject areas other than Computer Studies were selected in each school for focus interviews according to their interest and the subject which they were teaching.

In order to gain permission to go to the chosen high schools, the researcher followed the same process described in the pilot study. The researcher went to each district and asked the associate superintendent to write a letter to the principals of the high schools. The letter was provided by each district separately. Selection procedures for interviews were based primarily on accessibility as described in the next section. The researcher considers that the persons selected were knowledgeable and well informed as informants on the topics under study in their respective work environments.

3.4.2 Data Collection Instruments

3.4.2.1 Questionnaire

The questionnaires for different groups consisted of a different number of questions. The questionnaires included information on demographics, computer uses, computer experience, training courses, and participants' opinions. Both open ended and multiple choice questions were included in the questionnaires. The questionnaires were generated in English and translated in Persian by the researcher (See Appendix B).

To increase the validity and reliability of the instrument, the researcher followed Hoinville, Jowell and Airey (1978) and Babbie's (1973) suggestions as guidelines to writing the questions (cited in Wei, 1992).

The researcher first wrote the questions in English. The idea of the kind of questions which should be asked was taken from the literature review and from reading about similar studies from various countries. After writing the English version questions, the researcher translated them into Persian item by item. A Ph.D. candidate from Iran in the Department of Curriculum (Language Center) at OISE/UT examined the translation to make sure that the Persian and English versions were equivalent as much as possible.

Questionnaires were accompanied by a cover letter from the researcher providing general background information on the goals and methods of this research project. Confidentiality of data was also guaranteed. Ten days were allowed for completing these questionnaires and
returning to the researcher. All the collected questionnaires were examined to see if there were any unclear responses, and an interview was arranged with the participant to clarify those points.

### 3.4.2.2 Interviews

According to Borg and Gall (1983), the major advantage of the interview “is its adaptability” (p.446). Interviews were used as another instrument for gathering data from different groups in this study.

For interviewing, a semi-structured format was used; following procedures outlined by Good (1972) and Patton (1990), pre-written and general questions were used as the main prompts in eliciting information. Some guiding questions were written by the researcher to remind her of the broad areas of information to be asked. These areas included goals, current activities, factors facilitating or hindering the achievement of goals and possible suggestions for improving problem areas (See the list of questions for different groups in Appendix C)

The emphasis in the interview situation was on discussing those factors interviewees considered important. Questions were used just to initiate such discussion. Interviewees who spoke freely were asked fewer questions from the guiding list than those who needed greater prompting. Initially in each interview a general question was asked, and from then on, questions arose from what the participant was saying. However, on some occasions the researcher introduced a topic on which she required more information or comment.

**Beginning the Interviews:** The researcher began interviews by describing the research project, assuring the participants that what they were going to say was in confidence and that where quotations were used, the identity of speakers would not be revealed.

**Interviewing Procedures:** Some strategies were used to put interviewees at ease and to ensure a flow of discussion while at the same time acquiring information. These include: assurances of confidentiality, asking guidance from participants, probing questions, encouragement to continue, and verifying with interviewees that what they intended had been conveyed (Harvey, 1981)

The flexibility of the interviewer to allow interviewees to explore their experiences was essential (Harvey, 1981). The timing of the interview was also important. In order to allow for reflection to occur during the interview the researcher had to appear unrushed and willing to allow the interviewees to explore the topics they felt most comfortable with. As the interview
progressed the researcher pursued questions which they had not yet dealt with or topics which needed further probing. The interview also had to occur at a time convenient to the interviewees in order that they not feel rushed during the discussion.

All the discussion was written down verbatim. The interviewer avoided judgement or evaluative statements and encouraged an open and trusting atmosphere. Attempts were made to provide the opportunity for all participants to freely speak their mind with little interference or influence on statements by the researcher. The researcher used three kinds of approaches: (1) head nodding and saying (yes); (2) statements which rephrased content and reflected it back to the interviewee promoting clarity and understanding; (3) summarized statements which helped to interpret general ideas.

Government Officials' Interviews: The names of the policy makers and the persons who had been involved in establishing of the Computer Studies course were obtained from the Computer Group in Tehran.

Seven educators who had been involved in the process of planning and decision making for computer education in Iran were introduced to the researcher by the Computer Group in Tehran for interview. Three of these were on the computer committee whose job was to establish the Computer Studies course in the high schools curriculum; one was the designer and one was the author of the Computer Studies course. One was the head of the Organization of Educational Planning in Tehran, one was the head of the Computer Group in Tehran, one was an expert in the Computer Group in Tehran and the final policy maker was the author of the Computer Studies course for the new education system in Iran. For the sake of confidentiality the researcher refers to the seven policy makers under the codes: Mr. A., Mr. B., Mrs. C., ....

In the researcher's opinion, policy makers' interviews were the most important, since they had key information about the initiation and initial implementation of the Computer Studies course. They were also most difficult part of the data collection. Because all of the policy makers lived in Tehran, access to them was difficult (the researcher's residence was in Isfahan), the more so as they were very busy persons who had limited time to devote to an interview.

Interviews with the policy makers began by introducing the researcher and her background, the nature of the research, and the reason for doing this research. Questions about the situation of using computers in Iranian schools, the history of organizing this course, the purposes of putting this course into the curriculum, and how this thinking about computers developed were also included. The guidelines for interview questions of the policy makers are in
Appendix C.

Interviews with the experts in the Computer Group in Tehran was another source of data related to establishing the computer course. Interviews were conducted in the participant's office. The duration of the interview was between one hour to one and one-half hours.

**Interview with School Personnel**: Follow-up interviews were conducted with the principals who filled out the questionnaires and indicated that they were interested in providing additional commentary about their experiences in using computers. Sixteen of the principals from different kinds of high schools were interviewed. All computer teachers from the sample of selected high schools were interviewed. A number of the computer teachers also identified other teachers who were involved in teaching the Computer Studies course. Out of 17 computer teachers who were teaching Computer Studies in the thirty high schools, 15 were interviewed.

Interviews with some of the students were arranged when the students submitted their completed questionnaires. They were then asked whether they would like to participate further by being interviewed. A random sample of 35 students, from those who agreed, was interviewed within ten days of completing the questionnaires. Interviews were scheduled according to the participant's convenience and they were conducted on an individual basis. The duration of the interviews was between 30 minutes and forty five minutes.

In total 30 of the students' parents (5 from the pilot study and 25 from the main study) were randomly chosen from the students who had filled out the questionnaires. For choosing parents, at first the chosen students were asked to write their parents' name and their phone number on a sheet of paper. Then a telephone call was made, to inform parents of the research and ask if they were willing to participate in this study. In this short telephone interview, after introducing the researcher and the purpose of the research, some demographic information was gathered and the arrangements for an interview meeting were made. One parent from each family was interviewed, the choice being left to them. Thirteen of parents were mothers and seventeen were fathers. Nine of the thirteen mothers were housewives, three of them were teachers and one was working in an office. Fathers were from various professions. Two parents (one mother and one father) were illiterate and others had different level of education. In total, fathers were more educated than mothers. Four computer lab managers from these four districts were also interviewed.

All interviews took place in locations of the participants' choice: in their offices, staff rooms, classrooms, workshops, computer lab and principal's office. Interviews lasted from 45 minutes to 60 minutes. Notes were taken by hand as an event or interaction took place. As much
detail as possible was taken and an attempt was made to record dialogue in as close to verbatim fashion as possible. Moreover, whenever possible, for example when meetings were held, a second participant (the researcher’s husband) was asked to take notes.

In addition, the researcher participated in more formally organized activities and professional development workshops about computers, such as one principal’s workshop and computer teachers’ meetings. In these activities, for example, the researcher was involved in whatever the scheduled activity was, like listening to the main speaker. Meanwhile, behavior that may have been related to the study was noted.

The researcher also paid attention to any discussions which took place in the corridors and court yards of schools, the Ministry of Education, and in the district offices. Every opportunity was taken to converse with teachers and students about computer use, even in the family meetings. Most of these occasions were not conducive to taking notes. In the informal situations, trying to take notes would not only have been highly artificial but might have immediately stopped or altered the flow of conversation. Thus, the information which was obtained was used to expand the researcher's understanding of the situation or to pick up clues as to what was happening, so this could be followed up later. It was also used for interpretations that were evolving as the research progressed.

**Focused Interviews:** Another method which was used for gathering the data from teachers of other subjects was focused group interviews. "Focus group interviews are basically based on homogenous groups", (Patton, 1990, p.173). A group of eight teachers was chosen for a focused open ended interview. They were teachers from other disciplines such as science, art, and humanities who discussed the issues of computer use in the Iranian educational system. The focused interviews were conducted during breaks in the national examination schedule. The subject for discussion was why they did not use computer in their teaching and what were the solutions for the problems which existed in this field.

**3.4.2.3 Use of Archival Data**

At all times the researcher tried to elicit from participants those documents which were related to the use of computers in Iranian educational system. However, only four sets of documents were extensively used in this study.

(1) Documents from the Ministry that recorded plans and policies

(2) Documents from the Board of Education in Isfahan which contained the Ministry guidelines on computers, the circulars and correspondence, official publications and Reports,
memoranda from the Ministry and also the circulars and correspondence from the Board of Education to the province schools.

(3) Documents from schools, such as school district guidelines, school newsletters and teaching schedules.

(4) Other informal Iranian publications and magazines about computers.

3.4.2.4 Observation

The researcher visited all of the public school computer labs in the four districts: in each the researcher interviewed the computer lab managers and teachers who were involved with the computer program. For computer lab observation, the researcher spent about forty-five minutes in the lab and then spent the remainder of the class period interviewing students: the observation and student interview session was usually followed by an interview with the teacher, on the assumption that the teacher interviews would provide more insight if they followed the classroom observations.

The researcher took notes of the interviews and observations. In addition, important information from informal observation and talks (in hallways or during the recess time) were also noted. Under these circumstances, notes were made as soon as possible after obtaining such information.

Classroom observation focused on the structure of the class, student-teacher relationships and interactions, the role of teachers and students, teachers' strategies, questions that were asked, how teachers guided the class, problems that students had through working with computers, facilities in the classroom (hardware, software) and their physical arrangement.

In addition to observing hands-on practice in the computer lab, the researcher also observed four theoretical computer classes. Observation schedules were coordinated with principals and teachers. School observations were guided by the strategies of Bogdan and Biklen (1992). All public school computer labs were observed weekly during one month and a half (mid April to June 1995). A random sample of two private schools was observed, too.

Classes and workshops were also observed. On some occasions, students were preparing for examinations or doing independent study while the researcher and the teacher conversed. On these occasions, the physical surroundings and interaction between students were observed. On two occasions, the researcher was invited to attend workshops and teachers' meetings.
Observations in various situations and locations were used to enhance the researcher's understanding of the situation of computer use in the Iranian high schools. Such observations could be seen as ways of documenting actual occurrences that might have been used to supplement or verify information found in other sources.

### 3.4.3 Data Analysis:

**Analysis of the quantitative data:** All quantitative data collected by questionnaires were quantified with descriptive statistics by using the Statistical Package for the Social Sciences (SPSS) and presented in the forms of tables. The means, frequencies distributions and percentages were used to show the results. Most of these data were purely descriptive and are only referenced here where relevant to the discussion.

**Analysis of the qualitative data:** The researcher performed data analysis for the qualitative data in three phases: first, organizing the raw data into data files, second, developing a coding scheme and coding the data, and third, categorizing the extracted coded segments from the data files to describe and interpret trends and write the findings.

For organizing the raw data, first the researcher translated all the written data including interviews, open-ended questionnaire items and observation field notes collected in Persian, into English. An Iranian Ph.D. student who was studying in the Department of Curriculum (Language Center) at OISE/UT examined the translation to make sure that the Persian and English versions were equivalent as much as possible.

Separate data files for the seven groups of participants: policy makers, principals, teachers, parents, students, lab managers, and teachers of other subjects were produced and each file was numbered. When the raw data were organized into data files with numbered pages, the researcher started the second phase of data analysis, coding the data. Having translated all the data, the researcher was already somewhat familiar with the content of the data. However, the researcher reread through the data files in order to prepare a list of all themes (or topics). The researcher wrote in the margins of the text phrases which defined the topics, using phrases such as "social rationale" "access to home computers", "access to school computers", "in-service training courses", "pre-service training courses", "variation in knowledge" and so on. She then came up with a long list of topics and compared, eliminated redundancies, and then clustered them together as related topics under more general categories such as "introduction of CSC", "rationales for teaching and learning about computers", and "availability of computer related resources". These categories were chosen because of their close relation to the research.
questions and insights from previous research and theoretical frameworks. Each topic (theme) as well as the different categories were then given a code. Then the researcher read through the files once more, segmented the text according to the different topics and categories and coded each segment accordingly. Each segment ranged from one sentence to a whole paragraph. Sometimes, of course, more than one topic was detected in a segment, therefore, the segment was coded accordingly. For example, a segment such as “The first ideas related to computer literacy in schools began emerging some eight or nine years ago. The need for this course was due to the development of computers in the society and the importance of information and its influence in the world”, was marked both by the topic of ‘social rationale’ and by the topic of ‘historical background’.

In the third phase of data analysis, the researcher extracted the coded segments related to each category and topic from the coded data files, put them together or re-contextualized the segments (Tesch, 1990) and produced a print out of each. This process provided a cross-case (Patton, 1990; Yin, 1989) analysis for use by the researcher in identifying general tendencies in different groups for determining implementation issues.

The discussion of the implementation process was based on two sets of criteria: (1) the degree of conformity with certain major principles for successful implementation identified by Fullan (1992); and (2) the correspondence between the Iranian situation and the major characteristics of implementation in other countries as identified in the literature review.
CHAPTER FOUR

FINDINGS

This chapter reports the results of the study based on the data collected via questionnaires, interviews, policy documents and observations in schools during four months in 1995. Participants in this study were samples of different groups involved in the innovation, namely policy makers, principals, teachers, computer lab managers, students, and parents. Description of the profile of the participants including participants' demographic information, educational and career backgrounds, and some additional information about computer use in Iranian high schools, is included in Appendix (A.1-7). Throughout this chapter, extracts from the participants' questionnaires, interviews and the researcher's classroom (lab) observations appear, all of which were originally documented in Persian, and translated by the researcher into English. The questions in the questionnaires are reproduced in Appendix (B.1-3) and the interview schedules appear in Appendix C.

The Chapter begins with the results of the policy makers' interviews regarding the initiation process and the rationale for the Computer Studies course (CSC) and then the rationale of the other groups (teachers, principals, students and parents) is discussed. The availability of computer related resources, teachers' and students' access to computers at home and school, software availability, staff development and teacher motivational issues are discussed later, followed by other implementation issues in using computers and the role of socio-economic and socio-cultural factors such as gender issues. The chapter ends with a discussion of the positive effects of the Computer Studies course reported in this study and the future of computer education in Iran.

4.1 Background Information and Rationale for Using Computers

According to the policy makers, in 1987 the use of computers in Iran was rapidly increasing but "the spread of computers was not the same as it is today". Discussion at that time was about the need for teaching about computers. Some of the policy makers in the Ministry of Education thought that computer use would spread all over the world as well as in Iran. Therefore, if the students were not prepared for this, they would be left behind. They thought that there was a need for teaching about computers and it would have to be accepted voluntarily in the education system. However, other policy makers expressed a concern about spending the
education budget on computer literacy, at a time when there were other, more pressing needs to be met. They argued, for instance, that some of the rural places did not have any high schools, nor did they have any trained teachers. These policy makers were of the opinion that computers were a luxury and that the money should be spent on these more essential needs. Some of them were concerned about the long-term influence of the use of computers on the Iranian economy, for example, Mr. C said:

We are not producers of any computer parts. We should bring this technology into our educational system carefully and cautiously. If we do not consider these aspects, we would continue to be dependent on other countries and be a consumer for others' products. In this way, we create some false needs. In addition, the price of computers is very high.

Some of the negative attitudes towards computers prevalent in society such as replacing the thinking capability of human beings were also expressed. In response, some other policy makers, apparently more educated about computers, said that Iranian educators have to teach students about computers, so as to dispel this belief about the threat posed by computers to society. As a result of using computers, students will no longer think that they are working with a machine that has more power than they have. By learning a programming language, students learn how to control the computer. In response to spending money on other needs, these policy makers thought that every program should have its own budget, so that the budget for building schools and training teachers should be different from the budget for teaching about computers. However, after long and rigorous discussions, the Ministry of Education in Iran established a Computer Committee, in 1987, to develop a program for computer literacy. The rationale for teaching about computers was as follows:

**Social Rationale:** All policy makers believed that the rapid spread of computers in Iranian society and the importance of information and its influence in the world had caused them to decide to introduce computer literacy in the Iranian educational system. Mr. B. said that one goal of the educational system was to prepare students for the future. In the “near future”, all students should know about computers. “We started from the Math and Physics branch in order to extend this knowledge to other branches, too”. Some of the policy makers thought that in order to gain independence in the computer field they had to train experts. According to Mr. B.:

We do not want to be technology consumers of other countries and, on the other hand, we do not want our students to be alienated from computers.

According to Mr. F.: “Today the industrialized countries give us the technology and industry but they do not give us the information about that industry or that technology”. With the aid of
computers, people in developing countries would have easy access to a lot of global resources and information. Today researchers and scientists have access to different resources in the whole world by Internet. Computers could decrease the distance between different countries in the information field.

Public Interest: The public interest in computers and people's pressure for training their children was another reason for introducing computers in Iranian high schools. According to Mr. F., careful examination of the information about the number of students who had taken computer courses as an optional choice for KAD (Kar and Danesh) revealed the students' and parents' interest in learning how to use computers.

Mr. F. compared TV as an innovation with computers: He stated:

Remember the first time that television came, how people welcomed it. They all wanted to get a TV. Even in the rural places, I know a person who sold his cow which was the source of his income, in order to get a TV set. I know that the rural places which do not have clean water to drink, have TV sets. The government provided TV reinforcements in the furthest places because of the people's pressure to have and use it. Today, the furthest places of Iran have TV facilities and they can watch TV programs.

Mr. F. went on to say that new technologies such as T.V., radio, and even computers are very important and stimulate public interest. He said:

New technologies have a great power, attraction and spread. For example, when the TV shows some computer simulation programs in the news, people become curious and want to learn about these things. Most parents who purchase computers think that since they never had a chance to learn about computers, at least their children will.

Some of the policy makers thought that the public interest in computers was because of the newness of this technology and would diminish very soon; not all policy makers agreed with this. For example, Mr. F. argued that if some new technologies have no logical reason behind them and are used only because of their novelty, interest would soon diminish. As an example, he pointed out that in the first years of the Iranian revolution, the aquarium was a new form of entertainment and many families purchased it. This demand did not continue, however, because it did not have any special logic behind it. However, he thought that the computer was not just a passing fad.

Perhaps purchasing and learning about computers is similar to other new things, but I do not think so, because we have a logical reason for using computers. The future world is a computer world. Everybody should know how to work with computers. There is a new revolution, the information revolution, and the instrument for this revolution is the computer. This revolution is of the same
significance as the invention of the motor. The computer is a facilitator just like the motor.

According to the policy makers, there were several other reasons for people's interest in computers:
- People obtain identity or prestige by learning about computers.
- Some people are interested in having computers because others (e.g., their relatives or friends) have it. One of the policy makers stated:

  About ten years ago, I worked in the council of information, and many people came there in order to release their computers from customs. They have bought computers for their kids because they have heard about the different uses of computers from their families in other countries. At first, they bought Commodores for learning and painting and now they have PCs.

**Pedagogical Rationale:** According to the policy makers, by teaching about computers in the high schools, the universities would not be forced to teach preliminary and introductory courses to the students in the universities. Therefore, to prepare students for studies in the university was another mentioned rationale by the policy makers for teaching the Computer Studies course. According to Mr. B. in the same way that changes in Math education in the Iranian schools caused changes in Math education in the Iranian universities, teaching about computers in schools would change computer education in universities accordingly. With teaching about computers in high schools, introductory university courses about computers would not be needed. Participating in the International Computer Olympiad competitions was considered by the policy makers as another reason for teaching about computers. According to Mr. A., Iranian students had participated in other Olympiad competitions (Physics, Chemistry and Mathematics) and they received very high scores and rankings.

  Mr. F. further argued: "what the educational system does is to meet the needs of a society. As for the use of computers, the Iranian society began this movement and then the educational system followed".

4.1.1 The Process of Introducing the Computer Studies course

After recognizing the need for teaching about computers, the first objective was to determine how computer literacy should be introduced in the curriculum. According to Mr. A., the computer committee (which consisted of university professors in Computer Science and policy makers) decided that there should be a place for computer literacy in the formal education system.
To determine our objectives, we studied the use of computers in education in different countries, such as Eastern Europe, France, Canada (Halifax and Dalhousie) and other European countries. Another part of our research was to study other developing countries that have the same situation as ours. We have studied computer use in those developing countries that provided us with access to their information.

Another related activity was to participate in the Computer Olympiad Competitions and visit computer labs in other countries. One of the members of a computer committee who participated in the Computer Olympiad Competitions said:

In the Olympiad in China and France, we visited many computer labs. We participated in the UNESCO conference in Paris and we visited the computer labs in these places. After that we outlined the objectives for our computer course.

According to Mr. B., a professor in the Computer Science Department of an Iranian university, first, the social rationale for teaching about computers was considered and the Ministry of Education asked people to write their proposals. In the best proposal chosen by the Ministry, computer literacy was emphasized. The objective of that proposal was to introduce computers and their applications in different areas of science and life. According to Mrs. E., who was the editor of the Computer Studies course book, although the proposal was accepted as the best one, it was not considered seriously for the following reasons: First, providing appropriate hardware and software was difficult. Second, teaching according to the proposal required trained teachers who would be familiar with and work with various software packages and applications. Such teachers were not available. Finally, evaluation in the proposed course was problematic. There were no criteria available for student evaluation. Therefore, the objectives changed and the teaching about problem solving procedures and the BASIC language became the priority. They chose BASIC because it was easier than other languages.

In the new proposal, the most important objective for teaching this subject was to develop problem solving skills and to introduce students to algorithms. According to Mr. D. “By taking this course, the students would not be attracted to the magic of fancy graphics and games and would not be consumers of such games. He then went on to state the additional goals:

We have tried to teach the students one computer language, provide some general information about computers and give them an opportunity to work with computers.

According to Mr. A., after undertaking considerable research, it was decided that 11th grade in the Math and Physics major was the best:
(1) The number of students in the Math branch is less than in other branches, so to provide facilities for teaching these students is easier than in other branches with regard to the limitation of trained teachers and computer facilities.

(2) Another reason for choosing the Physics and Math branch was to attract more students to this major. Mr. A. and Mr. F. reported that most parents wanted their children to become medical doctors. So, the most talented students went to the Science branch, and the number of students in the Math branch decreased. So in order to attract more students the policy makers decided to introduce the Computer Studies course in this major. Mr. B. stated:

If you compare the number of students in the Math branch before and after adding the Computer Studies course to their curriculum, you will find a big increase in the number of students in the Math and Physics branch.

Another reason for choosing the Math and Physics branch was because of the emphasis of the Computer Studies course on problem solving. Students should have a Math background to understand the problems. According to Mr. A., in order to take the Computer Studies course, students should have some Mathematics background and a level of understanding that makes these students more eligible than others. In addition, students in grade 11 and 12 could take part in the Olympiad Competitions, so this was another reason for choosing grade 11. Grade 12 students had the same characteristics, but they were too busy with the University Entrance Exam (UEE).

Mr. D. said that for writing the Computer Studies course book, the computer committee reviewed the Iranian computer books and chose one as a framework for writing the Computer Studies book. The Computer Studies book was first published in 1990 and taught in a pilot study (1990-1991). This book changed greatly during subsequent editions according to the computer teachers' opinions, but the basis of the book and its framework had not been changed. The Computer Studies textbook consists of three sections. The first section is an introduction to computers (history and different parts of the computer), the second part is Algorithms and flow charts, and the third part deals with the programming language (BASIC). According to the policy makers, although the initial intention was to teach about the PASCAL language, the language used in the Olympiad Competitions, this was changed to BASIC. Mr. A. reported:

We thought it would be very difficult for teachers to learn this PASCAL programming language. Therefore, we changed it to BASIC. To learn BASIC is easy and it is a good programming language for beginners. It has a very small vocabulary and can be learned quickly.
The computer committee decided to include two hours of theory and two or three hours of practice per week. Because of the limited number of computers, this structure was later been changed to two hours of theory and one hour hands on practice per week. Every lab had to have ten computers and students were to work with the computers in pairs. In each lab, one computer was to be reserved for the computer teacher's use.

Teacher training was the second problem. It was decided that Math teachers were the most appropriate to teach this subject. According to Mrs. C., the Math teachers were the only ones who had taken some computer courses during their university studies. So, when the government was faced with the need for teaching the Computer Studies course, these teachers were the natural choice. She said that in addition to the in-service courses which were provided to the teachers:

We provided detailed teachers' guidelines for teaching this course, including additional materials and samples of computer exam questions.

4.1.2 Other Participants’ Rationale for Teaching and Learning about Computers

Hawkridge, Jaworski and MaMahon's (1990) rationale (social, vocational, pedagogical, catalyst) for using computers was used by the researcher as a guideline for writing the questionnaire/interview questions related to the rationale for using computers. Two other reasons for using computers, entertainment and success in the University Entrance Exam, were added by the researcher and were reflected in the questionnaires (Q.4.1 in the questionnaires of the Appendices B.1, B.2, and B.3). The results of this question and Q.5.8 in the interview schedule (Appendix C) are summarized in Table 4.1.

Table 4.1: Rationale For Teaching/ Learning About Computers*

<table>
<thead>
<tr>
<th>Rationale</th>
<th>Principals n= 30</th>
<th>Teachers n= 15</th>
<th>Students n= 219</th>
<th>Parents n= 30</th>
<th>Total N= 294</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>20 (70%)</td>
<td>12 (80%)</td>
<td>176 (80%)</td>
<td>16 (53%)</td>
<td>224 (76%)</td>
</tr>
<tr>
<td>Vocational</td>
<td>15 (50%)</td>
<td>0 (0%)</td>
<td>28 (13%)</td>
<td>20 (67%)</td>
<td>63 (21%)</td>
</tr>
<tr>
<td>Logical</td>
<td>12 (40%)</td>
<td>10 (66%)</td>
<td>119 (54%)</td>
<td>3 (10%)</td>
<td>144 (49%)</td>
</tr>
<tr>
<td>University</td>
<td>2 (6.6%)</td>
<td>0 (0%)</td>
<td>14 (6.4%)</td>
<td>6 (20%)</td>
<td>22 (7.5%)</td>
</tr>
<tr>
<td>Catalyst</td>
<td>10 (33%)</td>
<td>8 (53%)</td>
<td>97 (44%)</td>
<td>0 (0%)</td>
<td>115 (39%)</td>
</tr>
<tr>
<td>Entertainment</td>
<td>2 (6.6%)</td>
<td>1 (7%)</td>
<td>44 (20%)</td>
<td>0 (0%)</td>
<td>47 (16%)</td>
</tr>
</tbody>
</table>

* Note. Respondents chose more than one option.
(A) **Social Rationale:** As the results of table 4.1 indicate, the social rationale was chosen as the most important rationale (76%) for teaching and learning about computers by various groups in this study, e.g. principals, teachers, students and parents. Elements of the factors related to social rationale expressed by different groups in the follow-up interviews could be broken into the following segments.

1. **Not Being left behind:** Most people read, hear, or watch news about world progress in the computer field. They feel that if they do not learn about computers, they will be left behind and the distance between them and the industrialized countries would be increased. In addition, some of the participants in this study thought that perhaps the reason for other countries’ development was that they had access to these technologies and information and Iran did not. This reason was expressed almost by all of the participants in this study.

2. **Technology Independence:** Independence is crucial in different areas such as hardware, software and systems analysis. This rationale was expressed by various groups in this study. They thought that by teaching computer studies to the students, they would become interested in it. Some of the talented students would continue their studies in universities and be experts in different computer fields. The majority of principals, teachers and students thought that Iran has many talented students in this field. In addition, the students who won gold medals in the International Olympiad Competition showed that they had capabilities which should be encouraged and advanced. The researcher believes in the latter rationale, particularly for producing software, because most of the educational software which is imported from other countries does not match Iranian culture. The language of most software packages is not Persian. To train and have computer experts in different areas of computer science is also essential for the repair and maintenance of the computerized systems and for independence from foreign assistance in some of the computer fields. For example, in the Shah’s period, when a new technology came, the different experts came with that technology. They made the technology “work” but little effort was put into training Iranians in its use. After the revolution, most of the foreign experts left the country and today all of those industries are administered by Iranians.

(B) **Pedagogical Rationale:** The majority of teachers (66%), and 54% of students chose the pedagogical rationale as the second important rationale for teaching and learning about computers. They thought that learning about computers and in particular learning programming would help students to develop logical thinking skills and to learn better.

(C) **The Vocational Rationale:** The majority of parents (67%), and 50% of the principals in this
study thought that the vocational rationale should be the most important reason for teaching and learning about computers. Some of the principals believed that the importance of knowledge about computers would increase from day to day. Every day more work places are computerized and in the future they would need specialized persons who knew about computers. For instance, one of them said: “if you open the newspaper or magazines, you will see many employment opportunities for those who know about computers”.

Most parents chose the vocational rationale because they thought that the majority of jobs in the near future would deal with computers; therefore, if their children knew about computers they could find a job easily. To what extent this would be true is a question. But compared to five years ago when the researcher worked as a TV producer in Isfahan, there has been a big increase in using computers in many workplaces. The question is, if the schools are going to help students to find a job more easily, what exactly should they teach them?

Some people thought that the perceived need is not a real need. For example, one of the computer teachers in a private high school who had a bachelor in computer science argued that although many businesses and offices had computers, they did not really use them as much as they could. Although the number of computers had increased in many places, few computer related jobs were available. He said that most of the experts were trading computers in the market and many of them worked in unrelated jobs. The researcher thinks that this would change over time. By increasing the people’s knowledge about computers and familiarity with the capabilities and limitations of this new technology, they would use it more effectively.

In this study, although many parents believed that learning about computers would help their children to find a job, this rationale was not accepted by their children. The children thought that one of the most common jobs for the high school graduates is word-processing (typist) which students in the Math and Physics branch did not feel good about. Most of the students wanted to be engineers. Many of these students had a high intellectual ability and they thought that only the secretaries have to know about WP.

A large majority of students and teachers thought that learning BASIC would not help students to find a job. Instead of BASIC, learning some application programs would be more helpful. In general, students and teachers believed that the Computer Studies course would not help students to find a job more easily and if the objective was to prepare students for the future and to help them to find a job, the outline of the course should be changed.

The other two reasons, namely using computers for entertainment purposes and the rationale of “knowledge about computers would help students in the University Entrance
Exam", were not accepted as reasons for teaching about computers.

4.2. Availability of Computers and Related Resources:
In spite of the centralized system of education in Iran, there were some differences found among schools regarding the availability of computer resources and access to computers. The results of the interviews and observations regarding the districts' high schools access to computers are summarized in Table 4.2.

Table 4.2: Distribution of Computer Labs and Number of Computers in Four Districts:

<table>
<thead>
<tr>
<th>District</th>
<th>Public</th>
<th>Private</th>
<th>Public</th>
<th>Exemplar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># of Labs # of Computers</td>
<td># of Labs # of Computers</td>
<td># of Labs</td>
<td># of Computers</td>
</tr>
<tr>
<td>District A</td>
<td>1 12</td>
<td>1 3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>[1 Lab Public]</td>
<td>[1 Lab Private]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District B</td>
<td>1 11</td>
<td>1 4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>[2 Labs Public]</td>
<td>[1 Lab Private]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District C</td>
<td>1 10</td>
<td>1 4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>[4 Labs Public]</td>
<td>[2 Labs Private]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District D</td>
<td>1 12</td>
<td>0 0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>[1 Lab Public]</td>
<td>[1 Lab Exemplar]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8 70</td>
<td>4 15</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

As can be seen in Table 4.2., all public high schools in four districts had one computer lab with 10-12 computers. These computer labs were established by the Ministry of Education in the first year of implementation for using both genders. These labs were located in boy high schools with the high density of population. Recently, two districts had established separate computer labs for girls with 6-7 computers. Two others were still shared by boys and girls. Both of these shared computer labs had a separate door from the boys' high schools. In the following years, as the results indicate, more computer labs were established by high schools in some districts. One of the two shared computer labs was established on the second floor. On that floor, there were no other rooms except for the computer lab. In this lab there were 12 computers, one computer with a color monitor for the teacher and 11 computers for the students. The computer lab time in these two shared labs was distributed between boys and girls, one week for girls' use and one for boys'. The number of students in grade 11 Math and Physics in these
two districts was less than in other districts. In the observation of these two shared computer labs, 3 to 4 students were working with each computer. The people who lived in these two districts had a low level of income compared to other districts. Interviews with some principals from these districts indicated that they were interested in having a separate computer lab for girls.

The principals of two districts which had separate computer labs for both genders in their schools reported that they had shared computer labs in the first year of implementation, but because of the parents' pressure and support, the districts' administrators were compelled to establish a separate computer lab for girls. According to the principals of these two newly established computer labs for girls, the most important source of support was from parents, who provided the majority of the budget, and, the high school principal and district administrator helped to provide location and some other facilities. According to one of these two, her district administrator was very supportive because he was very knowledgeable about computers. The other district administrator was not very knowledgeable about computers, but public pressure caused him to be so supportive.

Through interviews with the principals, it was found that one of the districts had four computer labs, one for girls and one for boys, and two others which were established by students' tuition fees from KAD instruction for boys. Furthermore, because district administrators helped in establishing these labs, these two labs were also used for students in grade 11 Math and Physics if they were needed for hands on work of the Computer Studies course. Two students were working with each computer in this district. These computers were sometimes used for administrative tasks. These two public schools also arranged the extra-curricular computer programs for students willing to learn about computers and charged tuition fees from participants.

Most principals in the public high schools thought that they needed to have their own separate computer labs for teaching the Computer Studies course. Both principals from high schools with and without the computer labs were dissatisfied. The principals with the computer labs complained that the students who come from other schools caused discipline problems for the host high school. One of the principals stated:

The students which come from other schools are not familiar with our rules and sometimes it caused conflict. For example, one of our rules is to be in the school before the morning program (announcement) and students should go to classes in line. If the students come late to school they can not go to the class until the single ring. After the single ring all students who are late can go to the class. Our students know these rules, but the other students who come from other
schools to use the computer labs, sometimes have problems with these rules and it caused a lot of conflict. They refused to go in line to the class and this made the superintendents angry.

He said that one suggestion was to have another separate door for those students who came from other schools as a temporary solution and the real solution is to have separate labs.

In four of the public computer labs, there were two big shelves for software manuals and students' diskettes. Computer related books and software manuals (Database and WordPerfect manuals) were observed in only two of the shared computer labs and in the private computer labs. Most of the guidelines were in English but the computer books were in Persian. According to teachers, students could borrow the books from the computer lab manager or the computer teacher. In each of the computer labs, there was a white board that teachers used for teaching and solving some of the common student problems. In most of the observed computer labs, the computers were arranged traditionally in rows. In the girls' computer labs and private computer labs, computers were arranged around the periphery of the room.

The principals of the private high schools claimed that they did not have many problems related to computers. They had provided the computers from the students' tuition fees. The observed private schools had more powerful computers than the public high schools. Two of them had teachers with university computer backgrounds. They had extra-curricular computer programs for the students from other branches. The content of the extra-curricular program was an introduction to the computer and teaching BASIC language, taken from the Computer Studies course. In the interview with one of the private school principals, he said that he thought the labs had enough facilities and there was no need for more facilities in his school.

Only a few public school labs had a printer. All private high schools had printers. Printers were not allowed to be used by the Computer Studies course students. According to the principals whose schools had printers, they were to be used for administrative purposes only. The reason for putting the printers in the computer labs was for teaching about different peripheral instruments.

4.2.1 **Teacher and Student Access to Computers**

In this section, the results of teacher and student access to computers are categorized into two categories: (1) Access to school computers, and (2) access to home computers. First, access to school computers will be discussed.
4.2.1.1 Teacher and Student Access to School Computers

In the response to the following question “In what subjects have the teachers used computers in your schools?”, all ten principals who had a computer lab in their high schools reported that the computers were used for teaching the Computer Studies course. Only two principals reported that computers were also used for computer assisted instruction (CAI) purposes. One of these two principals chose Geography and Math and another chose Math. The teachers who used computers for CAI purposes were from public high schools.

In the response to “Are the computer facilities equally available for all students in your school?”, a large majority of the principals who had computer labs in their high schools reported that there was not equal access for all students. Only one of the principals reported that there was equal access for all students. In the interview, she said that her high school was the only girls exemplar public high school which existed in the province. This exemplar public high school was established for gifted students living in the rural areas and deprived of many educational facilities which existed in the urban areas. Therefore, these students could come to this weekly boarding high school which had a high level of educational facilities. All students from different majors in this high school could take computer literacy as their extra-curricular activity.

A large majority of principals (90%) who had computers in their schools reported that the students were not allowed to use the lab computers after school hours or during the weekends (Q.2.6 of the principal questionnaire in Appendix B.1). Both public and private school principals reported that their students could not use computers after schools hours. The results indicate that only students of exemplar public schools could use computers after school hours, but not on weekends.

In interviewing the computer teachers, they reported that they were not permitted to take computers home from the high school during the evenings or on weekends. In response to: “Do you have permission to use the high school lab computers for your personal purposes?”, the majority of teachers and all students replied that they could not use computers for their personal purposes. From among the thirteen teachers who answered, only two teachers responded positively to this question. These two teachers were from the public high schools which had computer labs and their principals were more knowledgeable about computers (these two principals had received both pre-service and in-service computer courses). Eleven teachers of thirteen answered no. The computer teachers who worked in the schools without computer labs had to travel to schools with labs for teaching the Computer Studies courses. According to the
computer teacher interviews, access to the computers was easier for teachers who had a computer lab in their schools.

In the follow-up interviews, the principals gave many reasons for not letting teachers and students use computers for their personal purposes such as: the policy guideline from the Board of Education, high expense of amortization, and the limited number of computers. In general, principals thought that computers were such precious instruments and they would be damaged by use. More emphasis was on not letting the computers be used than on their maintenance. All principals from private schools reported that they had provided computers from students’ tuition fees; therefore they should be very careful about their use. They argued that it would be too expensive to replace damaged computers and some of the principals who were more knowledgeable about computers reported that there was the possibility of software viruses.

4.2.1.2 Access to Home Computers

The results of the question, “Do you have a computer at home?” from computer teachers and students are presented in Table 4.3.

<table>
<thead>
<tr>
<th>Home Access to Computers</th>
<th>Computer Teachers n = 15</th>
<th>Students n = 224</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>2 (13%)</td>
<td>31 (14%)</td>
</tr>
<tr>
<td>No</td>
<td>13 (87%)</td>
<td>178 (79%)</td>
</tr>
<tr>
<td>Did Not Answer</td>
<td>0</td>
<td>15 (7%)</td>
</tr>
</tbody>
</table>

As can be seen, a large majority of teachers and students did not have access to home computers. In the interview, the teachers stated that they needed to have a computer at home. One of them said “teachers should have access to computers, they have to have it at home for practicing and learning”. Another teacher said “we suggest that the Board of Education or Ministry provides computers for teachers and deduct the money from their salary in installments”. He also mentioned that without the Ministry’s or Board of Education’s support they will not be able to provide computers for themselves, because of the high price of computers and their low salaries compared to the high living expenses. He also said “if the Ministry provides computers for teachers it would be cheaper because of the difference in exchange rate of dollars for government”.

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**Students home access to computers:** Only 14% of the students reported having access to a home computer. Of these, 15% of the boys compared to 13% of the girls had access to a computer at home. About 7% of the students did not respond to this question. The results for this question tallied by gender are presented in Table 4.4.

### Table 4.4: Students' Home Access to Computers Broken by Gender

<table>
<thead>
<tr>
<th>Home Access To Computers</th>
<th>Boys (n=122)</th>
<th>Girls (n=102)</th>
<th>Total (224)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>18 (15%)</td>
<td>13 (13%)</td>
<td>31 (14%)</td>
</tr>
<tr>
<td>No</td>
<td>94 (77%)</td>
<td>84 (82%)</td>
<td>178 (80%)</td>
</tr>
<tr>
<td>Did not answer</td>
<td>10 (8%)</td>
<td>5 (5%)</td>
<td>15 (7%)</td>
</tr>
</tbody>
</table>

In the response to "Do your parents let you use the computer at home?", from the 31 students who had a computer at home, 30 (97%) reported that they had permission to use it. Only one girl reported that her parents did not allow her to use the computer at home. In the follow up interview, she said that her parents did not let her use the computer, because they thought that it was wasting her time and she had to prepare herself for the University Entrance Exams (UEE). She said that she was allowed to use the computer during the summer and holidays.

As Table 4.5 presents, of the 14% (30) students who owned a computer at home and had their parents' permission to use it, 73% (67% of the boys, 83% of the girls) reported that they had used it for games and entertainment. Other important computer uses included graphics (65%), programming (58%), experimentation with computers (54%), CAI (38%) and typing (15%). As the results indicate, games and entertainment were the most commonly used by the Iranian students at home. Note that more girls than boys used the computer for entertainment and games. This will be discussed later in chapter 5.

A few students reported other uses of computers such as music and application programs. Interviewing students indicated that the students who were more knowledgeable about computers used computers in many different ways. For example, some of the students who had taken many computer courses had used the computer for as many as seven different types of activity.
Table 4.5: Types of the Home Computer Use by Students

<table>
<thead>
<tr>
<th>Computer use</th>
<th>Boys n=18</th>
<th>Girls n=12</th>
<th>Total N=30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Games</td>
<td>12 (67%)</td>
<td>10 (83%)</td>
<td>22 (73%)</td>
</tr>
<tr>
<td>CAI</td>
<td>8 (44%)</td>
<td>4 (33%)</td>
<td>12 (40%)</td>
</tr>
<tr>
<td>Familiarity with</td>
<td>9 (50%)</td>
<td>8 (67%)</td>
<td>17 (57%)</td>
</tr>
<tr>
<td>Computers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typing</td>
<td>3 (17%)</td>
<td>1 (8%)</td>
<td>4 (13%)</td>
</tr>
<tr>
<td>Programming</td>
<td>12 (67%)</td>
<td>5 (42%)</td>
<td>17 (57%)</td>
</tr>
<tr>
<td>Graphics</td>
<td>12 (67%)</td>
<td>5 (42%)</td>
<td>17 (57%)</td>
</tr>
<tr>
<td>Communication</td>
<td>1 (5%)</td>
<td>2 (17%)</td>
<td>3 (10%)</td>
</tr>
<tr>
<td>Others</td>
<td>5 (28%)</td>
<td>0 (0%)</td>
<td>5 (17%)</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Students chose more than one option.

As shown in Table 4.6., students who had computers at home were not using them to a great extent. The average number of hours per week of computer use for the girls was less than that for boys. For girls, the average was about 2 hours, while the average for boys was about 3.5 hours.

Table 4.6: Students' Use of Computers at Home

<table>
<thead>
<tr>
<th>Hours</th>
<th>Boys n=18</th>
<th>Girls n=12</th>
<th>Total N=30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than one hour</td>
<td>1 (10%)</td>
<td>2 (13%)</td>
<td>3 (10%)</td>
</tr>
<tr>
<td>One hour</td>
<td>1 (13%)</td>
<td>3 (23%)</td>
<td>4 (13%)</td>
</tr>
<tr>
<td>Two hours</td>
<td>4 (23%)</td>
<td>3 (23%)</td>
<td>7 (23%)</td>
</tr>
<tr>
<td>Three hours</td>
<td>4 (20%)</td>
<td>2 (13%)</td>
<td>6 (20%)</td>
</tr>
<tr>
<td>Four hours or more</td>
<td>8 (33%)</td>
<td>2 (13%)</td>
<td>10 (33%)</td>
</tr>
</tbody>
</table>

In the follow up interviews, students expressed their interest in working with computers but they had different reasons for not using them as much as they wished. The majority of the students pointed to the immense volume of the syllabus and said that they had to prepare themselves for a lot of material and homework. They said that they were going to school from 8
am to 5 PM every day and after school they had to prepare themselves for the next day, therefore during the week there was no extra time left for working with computers. During the weekend (only one day, Friday), they did not have any extra time either; in particular every weekend they had to prepare for one exam. This reason was given more often by girls than boys. It seems that girls were more worried about homework and exams than boys.

Interviewing thirty parents suggested that only four of them had computers at home. They were mostly from middle and upper class; two of them had university education and two others had high level of income and were working in the private sector (for more information about these four parents see Appendix A.7). These two later parents said that they had bought the computer for their children, because some other children in their family had a computer and their children asked them to buy one for them. They said that they did not know anything about computers but they had seen various uses of computers on TV.

In the interview with the parents who did not have computers at home, the majority of them (17 of 26) said that if their financial situation allowed for it, they would provide a computer for their children. Most parents wanted to have a computer at home because they thought that hands-on computer hours were not enough. For example, one of the students’ mothers said that her son was not satisfied with the Computer Studies course, because of the shortage of the computers. She said that many students were working with each computer. Another mother said “My son did not make any progress at the computer, because he did not have a computer at home.” In response to the researcher’s question about “how do you know that he did not make any progress?” she answered

Because of his score in his exam. I think that learning computer programming requires practice and hands on work, but the possibility for practice and hands on work is not available in our home or in our family. In our family only Haji(means her husband) has a high education level (college education), and nobody knows about computers to be able to help my son. On the other hand, our home is in Baharestan (a suburb of Isfahan) and it is very far from Isfahan. So, he can not use his classmates’ help, too.

Most parents thought that if their children had access to a computer, they would have learned much better, because computer skills are volatile and need a lot of practice. One of the parents said:

I think that the government and the Ministry of Education should invest more money into computer education. So, if I could not provide a computer for my children at home, they should have access to computers in the schools.
Another parent said that in Iran the use of computers in education was relatively new and was not considered serious enough. Many private classes were established to teach about computers. She said that private schools were equipped with all the facilities such as Physics, Chemistry, and Computer labs, but these facilities did not get used and the schools only had them, in order to get more money from the parents.

4.2.2 Software Availability and Use of Computer Assisted Instruction

In the response to this question: “What software do you have at school?”, all principals who had computers in their schools and filled out the questionnaire reported BASIC, six of the principals reported DANA (software for administrative use), and only two principals from private schools said they had some CAI programs. Observation of computer labs indicated that three of the public schools had some application programs such as word-processing in Persian; the systems software and programming languages were in English.

The most common software used by computer teachers was BASIC; a few teachers used each of the following applications: Games, Word, QBASIC in teaching the Computer Studies course (for more information see section 3.4.2 in Appendix A.3).

In response to this question of the teachers, “Have you ever developed any educational software by yourself or with others?”, only three of fifteen teachers who had a computer science bachelor's degree responded positively to this question. Two of these had produced software when they were students in the university as their class project. Another computer teacher had written software for teaching science in the Guidance level. His program showed the chemistry experiments. He said "we can use this kind of simulation program for teaching physics and chemistry subjects especially in the schools which do not have a lab". This teacher was asking for more support and encouragement from the Board of Education. He said:

We could not use the prepared packages, because of many factors such as different cultural values, different objectives, different language and different curriculum.

The other teachers said that they did not have enough time to think about writing software.

Interviewing principals about teacher use of alternative instructional tools in education indicated that the majority of teachers were not using any instructional tools, other than the blackboard. Most principals were not satisfied with the distribution of educational facilities and
said that some schools had slide projectors, overhead projectors and very good science facilities and others did not. Observations of these schools indicated that the facilities were not used by teachers. For example, one of the principals said that his high school was one of the most fortunate schools in the country in terms of access to an extensive amount of educational facilities such as access to Physics and Chemistry labs, and audio visual materials. But unfortunately the facilities were not used as much as they could have been, mainly due to the immense volume of the syllabus and the pressure to cover it because of the exams. Most principals and teachers of other subjects suggested that the syllabus is based on theory and needs a lot of memorization. Another principal said: “we have a Physics lab with a lot of facilities, but during the last year it was not used even once”.

In response to a question addressed to the students about their teachers’ use of CAI programs, almost all girls (101 out of 102) responded that there was no use of CAI. Only 12 (10%) responded positively to this question. In the follow up interviews with the students who had responded positively, they reported that their teachers had used CAI programs for teaching the CSC and six used them for teaching Mathematics or Physics. All of these students who reported that their teachers had used computers for CAI were from public high schools. There was no report about using CAI programs from private high schools. Most teachers of other subjects were curious and interested in using educational programs in their teaching, but they reported even if they had access to computers and the computer teachers’ assistance in installing the program, still the problem was that there were no suitable CAI programs in Persian. Some teachers reported that they were interested in finding some for their children but they could not. The head of the Bureau of Planning said: “I looked all over the Tehran bookstores and computer stores to find some good educational software for my kids, but I was not successful”. Most available CAI programs were in English and were not usable for students. This problem was also mentioned frequently by students. Most of the students who dealt with this problem said that they had used some CAI programs but they were not useful for them for these reasons: (1) English language problem, (2) the content of these programs was so different from the Iranian curriculum. The cultural issues related to using these programs were mentioned mostly by teachers.

4.3 Staff Development

The results of the questions related to the staff development programs (Section 3 of the principals’ and teachers’ questionnaires in Appendices B.1 and B.2) are summarized in Table 4.7. As the table indicates, computer teachers were the group which had the most pre-service training (for more information about the computer teacher training courses see Section 3.3 and
Table A 3.2. in Appendix A.3). The majority of the computer teachers reported that they had taken computer courses fifteen years earlier during university. According to the head of the computer group in Isfahan, such courses would have trained the teachers in FORTRAN, not BASIC, and on mainframes, not PCs. After graduation, most teachers had no opportunity to work with computers and could not update their knowledge. However, one teacher felt that even outdated and half-forgotten knowledge would help the teachers learn new programming languages more quickly.

Table 4.7: Staff Development programs

<table>
<thead>
<tr>
<th>Training Courses</th>
<th>Principals n=30</th>
<th>Computer teachers n=15</th>
<th>Teachers from Other Subjects n=16</th>
<th>Lab Managers n=4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-service</td>
<td>6</td>
<td>14</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>In-service</td>
<td>14</td>
<td>11</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

Interviewing other groups indicated that the most important source of their knowledge was computer inservice courses. Information about their in-service programs is included in Table 4.8.

Table 4.8: Duration of Computer In-service Training Courses

<table>
<thead>
<tr>
<th>Participants</th>
<th>1-20 hours</th>
<th>21-40 hours</th>
<th>41-60 hours</th>
<th>over 120 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Teachers</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Principals</td>
<td>9</td>
<td>0</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Lab Managers</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Other Teachers</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

As Table 4.8. indicates, most participants had less than sixty hours of training. Teachers of other subjects had received less computer in-service training compared to other groups (for more information about computer training for this group, see section 5.2.2 in Appendix A.5). As can be seen in the above table, 53% of the computer teachers had over 120 hours of teacher training. Some of the computer teachers pointed to the importance of the teacher training courses for teachers' confidence and self-esteem. One teacher told of an incident in which a student deliberately unplugged his computer, asked the teacher to fix the 'technical problem', and enjoyed the teacher's confusion. Such incidents, the teacher suggested, were common in classes in which the students doubted the teachers' competence. Computer teachers thought that for being competent in this area, they needed more training, in particular more time on computers. For example, one of the computer teachers said that in addition to participating in the in-service
training courses related to the computer, he had spent more than one thousand hours of his own time learning different aspects of computers. This was rarely reported by women in this study; they almost always reported that they did not find much time to spend with computers. In the follow up interviews, most of them suggested that they were willing to learn more about computers during their instruction in the university.

All different groups involved in implementing computers felt lack of enough knowledge. For example, One of the lab managers said:

If I have to have responsibility for the computer lab, first I should have the essential knowledge and then I could be responsible. Unfortunately, we are given the responsibility without essential knowledge.

The computer lab managers indicated the importance of computer knowledge. One of them said:

The big problem in the computer lab is that the computer teachers and I do not have any technical information about the computers. We do not know how to fix the problems. Sometimes for a very small problem or for not knowing a special password, we have to take the computers to the company for repair. The people in the company do not tell us any technical details because they just want money. They do not even tell us the essential passwords.

According to the lab managers, one of the most important needs for the lab manager is arranging more in-service training courses. One lab was recently equipped with networking which was not used because of different problems; the lab manager said that when the decision makers were going to bring a new system or networking, at first the computer lab manager and the computer teacher should be trained about the special passwords which are necessary to enter to the network. He said:

If we have special training, we will not have to send the computers to the company and we would be able to repair them. For example, the computers have gone to the company 7 times during this year. I think that they would not have gone, if we had the essential training. At the beginning of the year, we requested the essential training, but the computer company did not arrange the in-service training in time because they thought if we learned it, we would not need their help and they could not make more money. They enter special passwords, and when we ask about it they say “it is not your business. Or sometimes they say “it is not important”.

For most of the principals in this study, one immediate need was to learn about the application programs used for administrative purposes, such as word processor, data base and file
management system and especially DANA software (this Persian software is provided by the Ministry of Education and used for administrative tasks). In the interview with some principals who had taken computer courses during their in-service training, they reported that most computer courses were about teaching BASIC and programming which were not useful. They were more interested in learning computer applications.

The researcher had an opportunity to participate in the computer in-service program which was arranged by one of the districts for principals. In this in-service program, fifteen principals, 6 men and 9 women, attended to learn about computers. One of these participants was the Intermediate superintendent of that district. This workshop was given by one of the districts’ computer teachers. The duration of this computer in-service course was 20 hours. It consisted of 10 two hour workshops.

After the in-service training course about computers, some principals were dissatisfied with the duration of the course and they observed that the 20 hours of in-service training were very confusing and frustrating because it covered too many things in a short period of time. One of them said that he could not absorb all the new material which was presented at once.

Participating in computer in-service courses was not compulsory. The principals who were interested could participate in these in-service programs. Of course, the priority was given to principals who were piloting the New Education system. There were some privileges for the persons who took the in-service programs, such as obtaining some points for getting promotion. These points were necessary and important for getting grades and other promotions.

Some principals said that they had bought computers for administrative jobs but they had not used them because they did not have trained people. It seemed that to buy a computer was easier than to train the people to work with the computer. Some of the visited schools had computers but they did not use them because they did not have trained people.

Some of the principals said that teachers from other subjects had not taken any in-service programs related to computers but the computer teacher was ready to help them and in many cases other teachers brought their computer problems to the computer teachers. For more information about this group see Appendix A.5.

What was common among different groups was the need for more inservice training courses. The people who had already participated in the in-service training courses also argued
that what the teacher trainers taught in the in-service training was only about BASIC, which was not very useful for them; instead, if they taught them how they could use computers and about operating systems or use of some educational programs or application programs, it would be most useful.

Other problems concerning the computer teacher in-service training. One of the computer teachers complained that she had received only fifteen hours of in-service training. She reported that even though she had a bachelor’s degree in computer science, it was not useful to her because what was taught in the university was very different from what she had to teach in the Computer Studies course. Others suggested that the content of the in-service training be updated from the 1977 textbooks in current use, and the content and outline of the training be made known beforehand so that teachers could prepare themselves. It was also pointed out that in-service training should be made more frequently available so that teachers could keep up with the almost daily developments in computer science. In addition, they asked for more recent resources such as journals, books, conferences, and Internet. Another problem in updating the staff knowledge was the long waiting time required to receive the ordered written materials. For instance, one of the computer teachers said “I ordered one book from abroad for my term paper and I received it when I graduated!”

Some teachers wanted to be able to distribute their time between teaching math and computers. This means that more teachers than strictly necessary should be trained. When the computer Studies course was initiated, only 15 math teachers were recruited and trained. These teachers were responsible for teaching other teachers, who were committed to teaching the computer course regardless of personal choice because there were so few trained teachers. According to the head of the Computer group in Isfahan, some of these teachers were not competent to teach the computer course, but were kept because of the shortage of teachers. He suggested that more teachers than necessary be trained, so that those teachers who were incompetent or who no longer wished to teach the computer course could be reassigned. The teachers also suggested that, in addition to more and more frequent in-service training, they should have access to educational journals and other sources of information. They pointed out that the Board of Education subscribes to few journals, which often arrive very late, and that access to foreign journals was limited due to foreign currency problems.

4.4 Implementation Issues in Using Computers
The responses of teachers and students to the question “what kinds of problems did they experience in the Computer Studies course” are presented in Table 4.9.
Technical Problems: As can be seen in Table 4.9., the most important problem which was reported by teachers and students was technical problems. The second problem was insufficient hands on time on computers. Teachers reported variation in students' knowledge as a third problem while students reported insufficient number of computers as the third problem.

Table 4.9: Problems Experienced in the Computer Studies course

<table>
<thead>
<tr>
<th>Problems</th>
<th>Teachers</th>
<th>Students</th>
<th>Total</th>
<th>n= 15</th>
<th>n= 220</th>
<th>N=235</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical problems</td>
<td>13</td>
<td>200</td>
<td>213</td>
<td>87%</td>
<td>91%</td>
<td>1</td>
</tr>
<tr>
<td>Insufficient hardware</td>
<td>5</td>
<td>136</td>
<td>141</td>
<td>33%</td>
<td>67%</td>
<td>1</td>
</tr>
<tr>
<td>Insufficient software</td>
<td>5</td>
<td>110</td>
<td>115</td>
<td>33%</td>
<td>50%</td>
<td>1</td>
</tr>
<tr>
<td>Insufficient Hands on time</td>
<td>12</td>
<td>185</td>
<td>197</td>
<td>80%</td>
<td>84%</td>
<td>1</td>
</tr>
<tr>
<td>Insufficient time for theory</td>
<td>1</td>
<td>56</td>
<td>57</td>
<td>7%</td>
<td>26%</td>
<td>1</td>
</tr>
<tr>
<td>Lack of student motivation</td>
<td>7</td>
<td>69</td>
<td>73</td>
<td>47%</td>
<td>31%</td>
<td>1</td>
</tr>
<tr>
<td>Variation in students' knowledge</td>
<td>12</td>
<td>124</td>
<td>136</td>
<td>80%</td>
<td>56%</td>
<td>1</td>
</tr>
<tr>
<td>Students found concepts too difficult</td>
<td>6</td>
<td>56</td>
<td>62</td>
<td>40%</td>
<td>26%</td>
<td>1</td>
</tr>
<tr>
<td>Discipline Problems</td>
<td>1</td>
<td>50</td>
<td>51</td>
<td>7%</td>
<td>23%</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Respondents chose more than one option.

The problems reported by computer teachers and students are broken down by gender (for more information see Table A.3.3 and Table A.5.1 in Appendix A.3 and Appendix A.5). As can be seen in Table A.3.3, the technical problems were most mentioned by female teachers compared to males. Technical problems in working with computers also reported by other participants, in particular lab managers. All teachers and computer lab managers reported that because of technical problems, one or more computers remained unused for two or three months in the computer lab. Sometime, problems were not substantial but because of lack of technical knowledge of lab managers and computer teachers, the computers had to be sent to the company. According to the lab managers, during the first two years of implementation, because the computers were guaranteed they did not have many problems and the company fixed them.

The other technical problems identified by the computer teachers were:
(1) Insufficient computer memory to execute many of the educational programs. For example, some students brought application or CAI programs from home to present to the other students,
but they could not be run on the machines in the computer lab. Some computers did not have a hard disk.

(2) Lack of color monitors, reducing the students’ interest.
(3) High cost of repairs, causing broken computers to be out of commission for months.
(4) Lack of air conditioning and emergency power generation in many computer labs.
(5) Lack of technical support.

In the follow-up interviews with 35 students, a large majority of students (32), pointed to hardware problems such as the shortage of memory for executing some of the educational programs. They also reported that the monitors were black and white and not interesting for doing the graphical tasks. The students also reported that most of the time one or two computers with technical problems remained unusable for a long time. They said that sometimes in the middle of the program they had technical problems which even the computer teachers could not fix. Programs in English was another factor contributing to the complexity of this course. Most students said that sometimes the computer gave messages which they did not understand. One of them said “perhaps the main reason is my weakness in English language”. Another student said “sometimes the program does not work and I do not know why”. According to students, teachers and lab managers, lack of a support person in the computer lab contributed to the complexity of this technology.

Some of the principals who had computer labs in their schools said that sometimes computers remained unused for weeks or even for months because of the technical problems. All computers were guaranteed for two years, but after that the company was slow to fix the computers. Therefore, they requested more Ministry support in supervising and problem solving. Most principals said that one of their problems from the beginning was maintenance. They said that the maintenance of computers was not considered from the beginning.

Lack of Hands-on Time on Computers: According to teachers and students, three hours of hands-on time scheduled every two weeks is not enough for them. By the time they get used to the keyboard (the keyboards were in English), the time is finished. The novice students were very confused in this course and the most mentioned feeling was fear of failure. They argued that in order to take this course, familiarity with keyboarding and a little knowledge about computers were essential. One of the girls said “I had never seen a computer before, so at first it looked like a strange technology for me”. She went on to say:

At the beginning, I did not dare to touch the keyboard because I thought perhaps I would do something wrong and the computer would be broken and I would be
punished for that. So, for about two months I did not type and my other friends who had been in the computer classes before, typed and I watched them. After I began to type, I still had problems in finding the right keys, and usually my friends got tired when I was searching for the keys. So, I prefer that they type and I watch.

It is notable that in Iran typing skills were not taught to students as part of the formal curriculum, so the majority of students came to this course without any knowledge of the ordinary typewriter keyboard skills. This disability constituted a major inhibiting factor in the development of the computer operating skills. The following extracts are from the researcher's field notes from the observation of the computer lab.

Almost all students used a single finger for typing. In one group of 3 students, one of them did most of the typing while the others were looking on passively. In the interview with the girl who was typing, she said that she still had problems in finding the letters on the keyboard. She used one finger but because she had previously worked with a computer, she was chosen to type because she was faster than others. In interviews with 2 others in the group, they said that they were not familiar with the keyboard and it would waste time.

Misspelling and punctuation mistakes were normal mistakes with both genders. The girls' group was observed to be extremely slow on the keyboard. Most of them were not familiar with the keyboard and took too long to find the characters they needed. In some groups, the operator relied on the dictation and identification of the characters by the other members of the group. Poor typing skills were also observed among the boys. Some of the girls who did not have access to computers for a few months (their school was establishing a new computer lab for girls), said that at the beginning of the course they had to learn this course theoretically, without hands-on practice on computers. Therefore, it seemed to be a very confusing and boring course for these students. Some of these students said that they became discouraged because of lack of computer access.

**Variation in Students Knowledge:** One of the most frequently mentioned problems by teachers was the variation in the students' computer knowledge. The reason for this variation was because some students had more opportunity than others to participate in different computer courses before taking the Computer Studies course in the high school. Table 4.10. presents the students' responses to the question "Have you learned about computers before taking the Computer Studies course?". As can be seen in the table below, 65% of the boys compared to 17% of the girls responded that they had learned about computers before taking the Computer Studies course.
Table 4.10: Students' Previous Knowledge about Computers before Taking the CSC

<table>
<thead>
<tr>
<th></th>
<th>Boys n=122</th>
<th>Girls n=102</th>
<th>Total N= 224</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>79</td>
<td>17</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>65%</td>
<td>17%</td>
<td>43%</td>
</tr>
<tr>
<td>No</td>
<td>35</td>
<td>80</td>
<td>115</td>
</tr>
<tr>
<td></td>
<td>29%</td>
<td>78%</td>
<td>51%</td>
</tr>
<tr>
<td>Did not answer</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>7%</td>
<td>5%</td>
<td>6%</td>
</tr>
</tbody>
</table>

In the response to this question “How have you learned about computers?”, boys reported that the sources of their computer knowledge were: KAD instruction (80%), others (57%), friends (51%), myself (38%), private school (32%). In the follow up interviews with boys, they reported “others” as participation in computer classes which were arranged by religious organizations established after the revolution in Iran. As the table 4.11. indicates, most girls who had learned about computers before taking the Computer Studies course reported that they had learned about computers by themselves. The second source of girls' knowledge about computers was from participating in the private organizations. Table 4.11. presents the results of the above question.

Table 4.11: Sources of Students' Computer Knowledge

<table>
<thead>
<tr>
<th>Source of Knowledge</th>
<th>Boys n=122</th>
<th>Girls n=102</th>
<th>Total N= 224</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Organization</td>
<td>25</td>
<td>6</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>32%</td>
<td>35%</td>
<td>32%</td>
</tr>
<tr>
<td>KAD</td>
<td>63</td>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>80%</td>
<td>0</td>
<td>73%</td>
</tr>
<tr>
<td>Myself</td>
<td>30</td>
<td>13</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>38%</td>
<td>77%</td>
<td>56%</td>
</tr>
<tr>
<td>Friend</td>
<td>40</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>51%</td>
<td>12%</td>
<td>18%</td>
</tr>
<tr>
<td>Others</td>
<td>45</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>57%</td>
<td>6%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Note: Respondents chose more than one option.

Information about the courses which students had taken before taking the Computer Studies course is indicated in table 4.12.
Table 4.12: Computer Courses Topics

<table>
<thead>
<tr>
<th>Course Topic</th>
<th>Boys n=79</th>
<th>Girls n= 7</th>
<th>Total N= 86</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASCAL</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Databases</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Graphics</td>
<td>6</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>BASIC/QBASIC</td>
<td>74</td>
<td>5</td>
<td>79</td>
</tr>
<tr>
<td>DOS and Introduction</td>
<td>42</td>
<td>4</td>
<td>46</td>
</tr>
</tbody>
</table>

Note: Respondents chose more than one option.

As the table above indicates, a large majority of students, 94% of the boys and 71% of the girls who had taken computer courses before taking the Computer Studies course in the 11th grade reported that they had taken BASIC or QBASIC. Eight boys (10%) had taken both BASIC and QBASIC. Students had different reasons for taking BASIC. The most important reason was that almost all courses which were offered by different organizations taught BASIC. In the KAD instruction, BASIC was in their syllabus. Introduction to computers and DOS were other important choices for students. A few students had taken other computer courses such as Graphics (8%), databases (5%), and PASCAL (1%).

In response to the question about which year they had taken the computer course, the majority of students had taken the computer courses during the years of 1992-1993-1994, when they were already at the high school level. In the follow up interviews with some of the students who participated in the computer courses after 1991 their reasons for not taking the computer course before 1991 were:
- Because the computer was not as important as it is today.
- Because of English problems; teaching English was begun in the second year of the Guidance level. One student said “I did not know English very well, so I thought it would be difficult to participate in the computer course(s)”. Only a few students took a computer course when they had just finished the Guidance level.

According to the computer teachers, “it is very difficult to bring all students to a level where they can get maximum benefit from the Computer Studies course”. According to one of the boys’ teachers:
Usually the students with prior knowledge about computers do not pay attention to the course. The syllabus of the Computer Studies course begins with an introduction to different parts of a computer which is a repetition of what they had learned before. Therefore, in the second part of the book which is about problem solving and programming they still are unwilling to pay attention. Yet, the teacher still has to teach the other students. So, for teachers to keep a balance in these classes is very difficult or particularly impossible.
The situation in the girls' schools was somewhat different because girls did not take KAD courses about computers. Still there was also a variation in the girls students' computer knowledge. Some girls took part in private workshops, and in addition, some also had access to home computer and they learned from their parents about computers.

4.4.1 Teachers' Strategies for Overcoming the Problem of Variation in Students' Knowledge about Computers.

The boys' computer teachers reported that they had chosen different strategies for overcoming this problem. The following three categories of strategies were used for students who already knew about computers.

(1) Use stronger students to help weaker ones: Dividing students into groups by putting together in the same group one strong student who knew a lot about computers with one or two weaker students. Then the teacher would ask the stronger students to teach and help the weaker ones in doing the routine classroom homework.

(2) One of the boys' computer teachers grouped together more knowledgeable (strong) students and let them learn, with each other help extra-curricular topics such as QBASIC.

(3) Some teachers arranged groups of students with high computer experience together and asked them to do whatever they would like, such as: playing educational games or work with application programs. In an interview, one of the Computer Studies teachers said:

At first, students have to finish their homework and after that if they have enough time they could play or use other educational programs. There is no limitation on using computers for other purposes such as games but some of the computers do not have enough power or memory to execute some of the programs.

This kind of permission to use computers for whatever students would like is not acceptable to most of the computer teachers. Many of them did not permit students to do whatever they would like. It should be noted that most girls' teachers used the first strategy (use stronger students to help weaker students) in dealing with the existence of variation in students' knowledge about computers. There was no observation of the two other strategies (two or three) in the girls' high schools by teachers. When the female teachers were asked about using the third strategy in their classes, they disagreed and argued that the students have to follow their syllabus. One of them said that time is too short to be able to finish the syllabus and there is not enough time to do other things. Male teachers gave more freedom to their students compared to the
female teachers.

4.5 Impact of Socio-economic and Socio-Cultural Factors on Students' Computer Knowledge

A large majority of computer teachers (13) thought that the difference in students’ knowledge about computers arose from socio-economic and socio-cultural factors. Students from higher socio-economic status families had more access to computers at home and school, and could take computer courses as part of the fee-paying KAD instruction. Teachers also related cultural factors to computer instruction. For example, they noted that girls could not take the computer course as their KAD instruction, but had to participate in classes such as cooking, sewing, etc. According to a document from the Bureau of Education “KAD instruction is designed according to the capabilities of each sex as well as the cultural values which govern the Islamic society of Iran” (Iranian Ministry of Education, 1993, p.126).

Two teachers who taught in both boys and girls high schools noted gender-linked differences in learning habits. They felt that girls were more interested in computers because the computer represented a new area for them, although for novice students, both genders had the same motivation. They also stated that boys tended to be more exploring in their use of computers while girls tended to be more task oriented. One of the teachers said that girls tried their best to do whatever they were asked. According to him “Girls are afraid to take risks, such as trying to work outside the syllabus, or to play and do something with computers other than their homework. Boys are more creative and daring than the girls and they have more initiative”. Another point made was that “girls never criticize, because of their traditions and cultures”. The other teacher said, “for girls we have to teach everything, even small details. Boys are more independent and they carry out everything by themselves”. He argued:

I think the reason for this difference between boys and girls is the different ways of instruction and teachers’ styles. The second reason is that the girls do not have enough access. Or they do not have access to the resources that boys do. For boys there are many places such as computer clubs, Basij, Islamic council, Mosque, and others. The only computer related resource for girls is the book, so they learn it very well and they memorize it very well. Boys have more freedom, they can go to different places and learn about computers from different people, but girls must always be at home.

It is noticeable that although the computer teachers criticized male oriented nature of computer activities as a product of social norms and values, they also differentiated between two genders in regards to training. This will be discussed in the following section.
4.5.1 Gender issues in using computers

Table 4.13. presents responses to this question "In your opinion, which students should learn how to use computers?".

Table 4.13: Which Gender Should Learn about Computers

<table>
<thead>
<tr>
<th>Participants</th>
<th>Boys</th>
<th>Girls</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principals</td>
<td>0</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Teachers</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Students</td>
<td>4</td>
<td>4</td>
<td>212</td>
</tr>
<tr>
<td>Parents</td>
<td>8</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

As can be seen in Table 4.13., all principals, teachers, and a large majority of students thought that both genders should learn about computers. Twenty of the thirty parents (67%) said that both genders should learn about computers. Two of the parents who said that they did not know had less than primary education (for more information about this group, see Appendix A.7). Eight of the thirty parents (27%), 6 men and 2 female (housewives), said that only boys should learn about computers. These parents who chose male students mostly were from the groups who had negative attitudes or were indifferent (this will be discussed in the section of "Attitudes toward Computers"). The male parents who said that only boys should learn about computers mostly worked in the private sector. These parents argued that to work with computers is a male job and they thought that it was not good for females. Three of these people believed that girls should get married and their real job is bringing up the children and doing the housework. One of them said that the best job for girls was to be a teacher. He said that he did not like other jobs for girls.

All of the twenty parents who said that both genders should learn about computers expressed the opinion that the Ministry should provide equal facilities to teach about computers for both genders. In response to the question "If you had the choice to teach about computers only to one gender, which gender would you choose?", 16 of the parents said that they would choose boys. One of the four parents who did not choose boys argued:

I would teach girls, because they are going to be mothers, and they could transfer their knowledge to their children.

She said that she was illiterate and she was very embarrassed in front of her children; in
particular when her children asked her something, she was ashamed to say that she was illiterate; it was so painful. She put all of her energy into her children's education, and sent them to different classes to learn different arts. She also encouraged them to participate in computer classes. Her family had a low level of income, but she made handicrafts and from the money she had saved by selling them was able to pay for her children's private classes.

Another parent who was a teacher said that she thought that girls had to learn about computers because of their children. She said that her husband did not pay any attention to their children's education; this he left for her. She said that her husband thought that to do the job out of the house was the men's task and all internal matters were the women's responsibility. She said:

> Although both of us work outside of home, my husband, upon returning from work, sits down in the armchair and reads a newspaper and expects to be entertained.

The parents who chose boys had different reasons. Most of them argued that it was more important for boys to have a job, because they would have to support their families. They thought that girls would not have any responsibility for the family's financial support. Although most of them agreed with educating both genders, they thought that if they had to choose between two genders, they would choose boys. For instance, one of the mothers said that she put her son in private classes to learn about the computer but although her daughter was interested in learning about computers, because of limited budget, she did not let her participate in any private classes.

Some parents thought that working with computers was hard and women are too delicate to do this kind of work. Generally speaking, Iranian culture is male-dominated. All decisions are made by the men in the family. The men think that they are wiser and also have more physical strength than women. Most of them think that some jobs such as engineering, technical jobs, and any work related to the new technology is only for men. Therefore, as it was discussed, many male students took computer courses out of school. Some parents are ready to invest only in boys' education. They think that girls will belong to others after they get married but boys always belong to the parents' family. Recently, there has been a little change in people's attitudes towards gender. The women are asked to participate in family decision making and many of them are working in the areas which belonged to men for many centuries. It has happened mostly in the families which have a high level of education and income.

The results also indicate that other participants (teachers, principals, students) in this study also differentiate between two genders regarding what they have to study. Table 4.14 and Table
4.15. indicate the areas chosen for each gender by participants.

**Table 4.14: Suggested Areas of Computer Study for Boys**

<table>
<thead>
<tr>
<th>Participants</th>
<th>Word processing</th>
<th>Spread Sheet</th>
<th>Data Bases</th>
<th>Communication</th>
<th>Programming</th>
<th>Hardware</th>
<th>Graphics</th>
<th>Operating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principals</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>17</td>
<td>19</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>n=30</td>
<td>0</td>
<td>7%</td>
<td>10%</td>
<td>33%</td>
<td>57%</td>
<td>63%</td>
<td>7%</td>
<td>30%</td>
</tr>
<tr>
<td>Teachers</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>13</td>
<td>9</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>n=15</td>
<td>33%</td>
<td>27%</td>
<td>33%</td>
<td>40%</td>
<td>87%</td>
<td>60%</td>
<td>47%</td>
<td>87%</td>
</tr>
<tr>
<td>Students</td>
<td>15</td>
<td>20</td>
<td>24</td>
<td>68</td>
<td>95</td>
<td>157</td>
<td>52</td>
<td>178</td>
</tr>
<tr>
<td>n=212</td>
<td>7%</td>
<td>9%</td>
<td>11%</td>
<td>32%</td>
<td>45%</td>
<td>74%</td>
<td>25%</td>
<td>84%</td>
</tr>
</tbody>
</table>

**Note:** Respondents chose more than one option.

The first choice by each group is indicated in bold and underlined, the second choice is bold, and the third choice is bold and italic.

**Table 4.15: Suggested Areas of Computer Study for Girls**

<table>
<thead>
<tr>
<th>Participants</th>
<th>Word processing</th>
<th>Spread Sheet</th>
<th>Data Bases</th>
<th>Communication</th>
<th>Programming</th>
<th>Hardware</th>
<th>Graphics</th>
<th>Operating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principals</td>
<td>10</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>15</td>
<td>2</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>n=30</td>
<td>33%</td>
<td>7%</td>
<td>10%</td>
<td>33%</td>
<td>50%</td>
<td>7%</td>
<td>43%</td>
<td>20%</td>
</tr>
<tr>
<td>Teachers</td>
<td>11</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td>4</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>n=15</td>
<td>73%</td>
<td>47%</td>
<td>40%</td>
<td>40%</td>
<td>80%</td>
<td>27%</td>
<td>53%</td>
<td>80%</td>
</tr>
<tr>
<td>Students</td>
<td>34</td>
<td>27</td>
<td>25</td>
<td>72</td>
<td>134</td>
<td>58</td>
<td>108</td>
<td>169</td>
</tr>
<tr>
<td>n=212</td>
<td>17%</td>
<td>13%</td>
<td>12%</td>
<td>35%</td>
<td>65%</td>
<td>28%</td>
<td>53%</td>
<td>82%</td>
</tr>
</tbody>
</table>

**Note:** Respondents chose more than one option.

Comparing two tables (Table 4.14. and Table 4.15.) indicates that three most important choices were different for boys and girls. Both teachers and students thought that both genders had to learn about operating systems as the first choice. Principals chose hardware engineering as a first choice for boys; students and teachers chose it as a second important subject for boys. Programming was chosen as the most important subject for girls by principals. Teachers chose programming as their second important subject for girls. As the data in Table 4.14. and Table 4.15. indicate, students themselves differentiate between the two genders regarding the subject of computer learning. Girls chose Hardware and computer engineering as their second choice for
boys (81%), while only 38% of the girls chose hardware engineering as a topic for girls to learn. The reasons for this kind of attitude will be discussed later in this chapter. The students’ choices are broken down by gender and it is indicated in two tables (Table 4.16. and Table 4.17)

**Table 4.16: Computer Topic Choices for Girls**

<table>
<thead>
<tr>
<th>Computer topic</th>
<th>Boys n= 105</th>
<th>Girls n= 100</th>
<th>Total N= 205</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word-processing</td>
<td>27 26%</td>
<td>7 7%</td>
<td>34 17%</td>
</tr>
<tr>
<td>Spreadsheets</td>
<td>20 19%</td>
<td>7 7%</td>
<td>27 13%</td>
</tr>
<tr>
<td>Databases</td>
<td>15 14%</td>
<td>10 10%</td>
<td>25 12%</td>
</tr>
<tr>
<td>Communications</td>
<td>38 36%</td>
<td>24 24%</td>
<td>72 35%</td>
</tr>
<tr>
<td>Programming</td>
<td>86 82%</td>
<td>48 48%</td>
<td>134 65%</td>
</tr>
<tr>
<td>Hardware Engineering</td>
<td>20 19%</td>
<td>38 38%</td>
<td>58 28%</td>
</tr>
<tr>
<td>Graphics</td>
<td>53 50%</td>
<td>55 55%</td>
<td>108 53%</td>
</tr>
<tr>
<td>Operating systems</td>
<td>88 84%</td>
<td>81 81%</td>
<td>169 82%</td>
</tr>
</tbody>
</table>

**Note:** Respondents chose more than one option.

**Table 4.17: Computer Topic Choices for Boys**

<table>
<thead>
<tr>
<th>Computer topic</th>
<th>Boys n= 105</th>
<th>Girls n= 100</th>
<th>Total N= 205</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word-processing</td>
<td>7 6%</td>
<td>8 8%</td>
<td>15 7%</td>
</tr>
<tr>
<td>Spreadsheets</td>
<td>12 11%</td>
<td>8 8%</td>
<td>20 9%</td>
</tr>
<tr>
<td>Databases</td>
<td>14 13%</td>
<td>10 10%</td>
<td>24 12%</td>
</tr>
<tr>
<td>Communications</td>
<td>41 39%</td>
<td>23 23%</td>
<td>64 31%</td>
</tr>
<tr>
<td>Programming</td>
<td>71 67%</td>
<td>24 24%</td>
<td>95 46%</td>
</tr>
<tr>
<td>Hardware Engineering</td>
<td>79 75%</td>
<td>78 78%</td>
<td>157 77%</td>
</tr>
<tr>
<td>Graphics</td>
<td>39 37%</td>
<td>13 13%</td>
<td>52 25%</td>
</tr>
<tr>
<td>Operating systems</td>
<td>97 92%</td>
<td>81 81%</td>
<td>178 87%</td>
</tr>
</tbody>
</table>

It is noticeable that in the students’ interviews, boys never raised problems related to gender
issues, but all girls did. This was the reason why in this section, more results are from girls. The researcher had two different opportunities to have a focused interview with the girls in a classroom during a time when the teacher was absent. One school was from a low socio-economic status and another was from a higher status. Both groups of students complained about a lack of access to computers. Students in the low socio-economic level said that 3 to 4 students had to work with each computer in the computer lab, so they did not have enough practical time on computers. None of these students had any chance to work with computers other than the hours of hands-on practice on lab computers.

Students from the higher status school said that for a few months at the beginning of the year they did not have access to school computers, because their school was establishing a separate computer lab for girls and the lab was not ready. Therefore, they studied this course only theoretically without hands-on practice for a few months. Most girls thought that if they had been boys, the principals would not have dared to do that. One of the girls said “boys are brave, if they were in our situation, they would have objected. We are so scared of marks, and the principal knows that”. They said that girls were not unified; most of them were afraid of getting bad marks, so they did not object. Then, they analyzed this problem and said that for their parents’ satisfaction, they tried to get very good marks. They said that their parents expected more from them than from their sons. Most students brought many examples of the differences which their parents made between them and their brothers. One of the girls said:

We are afraid to get bad marks, this is because of our parents’ expectations, our parents expect us to accept what they say and according to their norms and values, if we want to be good, we have to be obedient. We have to have good grades. So, we have to memorize to get good grades. My parents blame me for bad grades, but they do not blame my brother.

Another girl said “when I get a mark less than 20, I have to hide it, because my parents will get angry, but my brother could get any mark without blame”. Girls said that their teachers also expected too much, “a good student is one who is silent, obedient, memorizes and does not ask questions”.

Girls from both schools were dissatisfied with their situation as girls. They compared themselves with boys and said that boys had more learning opportunities than girls. Boys could go to different computer classes, even without telling their parents, but girls could not. Even girls from families with a high socio-economic level were not allowed to participate in any classes without their parents’ permission. When participating in extra-curricular classes, usually girls had to go with their parents. They had less opportunities to spend time with their friends or
their classmates compared to boys.

Girls from the district with a low socio-economic level had less freedom. According to many of these girls, the only place which they were permitted to go was the school. They were not allowed to go shopping by themselves. One of the girls said:

I can not think independently because I did not learn how to become independent. From the time that I can remember, I always went with my family for shopping, most of the time they decided what I have to wear, even the color of the cloth. The only place permitted to go was the school. I even could not participate in any extra-curricular activity which was kept in my school during the summer or holidays.

No students in this class had ever participated in a computer course. They suggested that not only could they not afford the high price of the private classes, but even if they could, their families preferred to send them to sewing classes, because they thought that it would be more useful for girls than computers. They said that their parents thought that girls’ job was to marry and bring up kids, so they should stay at home. “Men should work and be out of home”. They said that if their parents had money, they would invest in their boys. For example, one of the students said “they sent my brother to a private computer class and spent a lot of money on him”.

They thought that the public’s notions that men could think better than women, or that men were more technically oriented because they could not find many women in technical jobs. One student said, “I have never seen any women in technical jobs on TV”. One student said to have women in different types of jobs, in particular in the fields which were dominated by men, would provide role models for girls and the society in general. She gave the following example: “When our principal came and said “one lady who is studying for her Ph.D. in Canada is coming here to visit your class for her research, I felt proud and surprised. It was encouraging for me, because I never thought that women could go to abroad to continue their education”. This point was also mentioned by some other students. However, some students from a low socio-economic level said that they thought there was a mental difference between men and women. They said that in their families, men do more technical jobs.

Although girls in the school with the high socio-economic status had much more freedom, they still had many problems because of the social values and norms. They said that although their parents did not believe in most of the social restrictions of girls, they had to obey these restrictions. They said that their parents were trained to think that there was a difference between men and women. One of the girls said, “my parents say that there is no difference
between me and my brother, but I see that they behave differently with me and with him; for example, he could open any electrical equipment and break it, but if I want to do, they will say that it is not my business”. Some girls objected that their parents expected more of them than of their sons. They said that the social norms governing the society caused their parents to think the same way. The girls from the higher socio-economic status did not believe that there was a mental difference between men and women.

In addition to the focused interviews in these two classes, the researcher interviewed seventeen other girls who were interested in being interviewed. They also reported the same problems. All were dissatisfied with their situation. They said that compared to their brothers, they had less opportunity to have access to computers. They also pointed to the impact of social values and norms on girls’ education, especially on learning about computers. They had less opportunity to take computer courses. Regarding participation in private computer classes, one of the girls said “I can participate, but it should be at a time that my father could come to pick me up”. Another girl said: "My parents prefer to send me to classes which are administrated by the high schools”.

Qualitative differences between the behaviour of boys and girls were also noted during the classroom observations. Girls indicated a desire to finish an assigned task satisfactorily. During teaching they waited for instructions, asked permission to do things and rarely moved from their desks, and if they moved the teacher would ask why. In one of the girls’ classes, the students were very quietly entering the solution to a problem in the computer without any discussion. In other words, they did not have permission to move around in the classroom and go to other students’ desks. The computer teacher in the girls’ classes tried to keep the class silent with the same discipline as classes of other subjects.

Boys, on the other hand, seemed to find the tasks more interesting and worked freely. They raised questions about procedural matters. They shared amongst themselves the procedures for solving problems, not only with their groups, but with other groups. Boys had more freedom to move in the classroom, to go to other desks and see the other students’ solutions to the problems. It seemed that more knowledgeable students had more freedom than other students. Some of them worked on projects out of their syllabus. They did not care about their teachers’ demands to be silent. Boys often tended to remain at the computer after their tasks were completed. In summary, the boys acted more actively and inquisitively than did the girls.
4.6 Other Issues Related to the Computer Studies course

4.6.1 Lack of Clarity about Objectives

Some of the computer teachers reported that there was some confusion about the objectives of the Computer Studies course. They thought that if this course was about computer literacy why should it be only for students in grade 11 of Math and Physics. They thought that if the objective of the course was teaching about problem solving and mathematics, why were the problems and the content of the course very different from other math courses. In addition, according to computer teachers who were also teaching mathematics, the problems in the computer book were very abstract and they were unrelated to the real life. A majority of students were not sure about the objectives of this course. Most students (26 of 35) said that they came to this course with the idea that by taking this course they would learn many things about computers and their different applications. According to the students, contrary to this supposition, in practice the course was very different. Most students said that they did not even learn how to format the diskette, because the lab manager took their diskettes at the beginning of the academic year and checked for viruses and then formatted them. They said that this course was only about problem solving and BASIC language. Thirty of the 35 interviewed students objected to the type of Mathematics problems which were covered in their Computer Studies course book and said that those problems were so confusing and unrelated to what they have had in their other Mathematics subjects. They said that each problem had many parts (more than 10 parts). One of the students said that if the objective was to learn about computers, why were there so many difficult problems. The students also said that the math problems in the Computer Studies book were unrelated to their real life problems.

A majority of computer teachers were not sure about how students could use the knowledge from this course. One of them said “teaching about this course is similar to teaching students about alphabetic letters without showing them how they could use these letters”. They compared the Computer Studies course with other courses and stated that students had to take this course only once during their school education, compared to most subjects such as social studies or math which students had to take many times during different years of elementary, guidance and high schools. Most students also pointed to discontinuity of this course and complained that this course was offered only in grade 11 Math and Physics and did not continue in other grades.

Most students (23 of 35) claimed that the content of the course was very different from what they had expected. Some of them thought that BASIC was not a suitable language. For
example, one of the boys said:

To know about BASIC is not enough to find a job or write programs in business. My friend wrote an accounting program and he earned about 120,000 tomans ($400) during two weeks. I have not seen any written program in BASIC language that could be applied in business”.

Some of students (5 of 16), who had taken other computer courses before, were wondering why they had to take it again. For example, one of them said that he had passed BASIC three times in different classes and he said:

I do not know why I have to take it again, it is boring for me. Why students who had taken this course have to take it again? They should have other choices such as participating in another computer course.

One of boys said “BASIC is a primary language and it doesn't have any application”. They said that instead of BASIC, learning how to work with computers and how to communicate with them would be more useful. Most students believed that this course could not help them find a job. Moreover, this course was not included in the UEE; therefore some students thought that spending time on this subject was wasting time before UEE. Some students thought that after passing the UEE, they would have more time and would work on this subject.

4.6.2 Perceived Value of the Computer Studies course

In the follow up teacher interviews, one of the boys’ teachers argued that “The Ministry of Education should place more emphasis on this course by including it in the UEE”. He compared this course with other subjects, such as Arabic, whose coefficient in the UEE was four. Another teacher said that not even one question from the Computer Studies course was in the UEE. She suggested that questions from the Computer Studies course should be included in the UEE so that students consider it more seriously. In general, all teachers stated that the most important goal of every one at the high school level (principals, teachers, students, parents) is success in the UEE. Principals are evaluated on the basis of the student percentages of acceptance in the UEE, and those with high percentages of student acceptance in the UEE could get more support from both inside and outside of the educational system. These schools could get higher parents’ financial support compared to the other schools with lower UEE student acceptance percentages. It was very prestigious for teachers to work in these schools. Teachers in these schools could expect to have many private students and could make extra money. These conditions caused all the personal efforts in the high school to be concentrated on the subjects which are included in the UEE. One teacher said, “parents expect us to teach only subjects which are included in the UEE and they think that to spend time on the subjects which
are not included in the UEE is "wasting time". With regard to this situation, the teachers' suggestion was to include the Computer Studies course in the UEE.

According to the computer teachers, the Computer Studies course substituted for the KAD instruction. Therefore, students did not pay as much attention as they could. One of the computer teachers said "KAD means pleasure and fun for students". The teachers stated that at the beginning of the year, students do not consider the Computer Studies course as important because the hours of this course were taken from the KAD. In addition, compared to the other subjects, principals did not pay much attention to this course.

4.6.3 Complexity of Teaching the Computer Studies Course

The computer teachers had some justification for complaints about the complexity of their jobs. In the interviews, they reported that teaching the Computer Studies course needed a lot of expertise in different areas to be able to meet their job expectations. For example, one of the computer teachers said:

As a Computer Studies course teacher, I think that the computer teachers have to know a lot about computers. Because not only do students ask different questions, but also many teachers, and even parents who deal with computers, bring their computer problems to us, and they think that the computer teacher has to know everything about computers. Additional demands come from other teachers and people from outside the school, who are curious and want to know and learn about computers.

According to the computer teachers, use of computers for administrative tasks made additional demands on teachers; most of the time they were asked by the book-keeper and the principal about different problems that they were faced with. A few teachers in this research gave workshops to other teachers and principals within and beyond their schools. These workshops were arranged by districts of education. The Board of Education asked some computer teachers to prepare a guideline and an outline for a computer course in KAD instruction.

According to one of the computer teachers, extensive information through radio and television about computer applications made for high expectations of computers from society, and, particular, students and their parents. They expect to see or do some of what they had seen or heard through these media in the computer classroom.

In addition to problems arising from the newness of the computer course, there were difficulties keeping up with rapid developments in the subject, unlike other, more traditional
subjects. They had to know about the technical parts of computer and be familiar with a few tools, such as spreadsheets, databases, and word-processing. They should have this new knowledge not only because of their students but because of the society and other teachers and principals. According to the majority of computer teachers, managing computer classes (hands on) compared to other classes is more difficult because of the nature and structure of the lesson. Teachers in these classes should be more patient. In addition, sometimes students are more knowledgeable than teachers and there is a big difference between this course and other subjects. According to the computer teachers who had math teaching experience, “we always had been more knowledgeable than our students, but in this course it is reversed”. The computer teachers argued that using computers in education needs some skills, but achieving them is difficult. In other words it costs both time and mental energy, in particular for teachers from other subjects who do not have related computer experience. In addition, these teachers have other responsibilities such as meeting all of their regular curricular and extra-curricular activities. Software in English was another issue in the complexity of this technology. One teacher reported:

sometimes in the process of performing the program, the computer gave a message that I do not understand, and I have not seen that message before, so I do not know the meaning of it. Perhaps if the message was written in Persian, I could understand it.

Most computer teachers suggested that they had to have communication with other computer teachers and also with people from outside the school who worked in this field to reduce the complexity.

According to the principals, the lack of space, electrical outlets, even finding an extension cord, became serious issues in establishing a computer lab in the schools. In addition to hardware, software, space, equipment, bulletin boards for displaying students’ work, they needed to invest in security and maintenance.

4.6.4 Teachers’ Consensus and Motivation

According to the computer teachers, although they were chosen to teach the Computer Studies course based on their interest, some of them were not happy with their choice due to the complex, time-consuming nature of the course and the lack of encouragement.

Some of the computer teachers were not satisfied with their jobs from the financial point of view. They argued that in teaching mathematics, teachers could make extra money during
their free time, but in teaching the Computer Studies course they could not, for the following reasons:

In the field of computers there are more professional people than we are and they can teach computers better than us, so there are not many private classes for computer teachers and on the other hand, we need math teachers more than computer teachers because of the spread of math. Even in the farthest places in Iran, they have math in their curriculum but they do not have the Computer Studies course.

Another reason was that the Computer Studies course was not included in the university exam. According to the computer teachers, teaching this course caused lost income from the activities which were undertaken during the teachers' free time. According to Williams in Sub-Saharan Africa (1986, cited by Makau, Kenya, 1987)

Economic constraints have bitten deeply into the real value of salaries of teachers. They are tempted to engage in other economic activities to supplement their incomes. Moonlighting by doing un-authorized supplementary work and in urban areas particularly drawing an increasing share of their income from private coaching (p. 97).

According to Makou (1987) in Kenya, teachers, compared to other employees in the public sector, were underpaid and teachers have to do extra jobs and in many cases unrelated jobs such as coaching, driving or having a store for making extra income. Because of that, first they did not spend more time on the computer for updating their knowledge.

In the research on Iranian teachers, none of the teachers interviewed had such jobs as coaching or driving or having a store, but they were interested in having private students. Most of the computer teachers also were interested to be also math teachers and have a few hours of math teaching. According to one of the computer teachers, "in our society people think that math is a very important and difficult lesson, so most of the students (especially in the family with high income) have private teachers for teaching math to their children. Therefore, computer teachers are not satisfied in being accepted only as a computer teacher and they wanted to teach some math courses too". It is supposed that some teachers had participated in the computer course because they thought that learning about computers would provide them an opportunity to earn extra income and to enhance their employability through formal certification. They were, therefore, disappointed. For the reasons mentioned, most of the computer teachers wished to teach both math and the Computer Studies courses.

The computer teachers argued that they should be paid more than the teachers of other subjects; because the practical computer lessons were very difficult. Unfortunately, they had to
teach the same number of hours for the same salary as other teachers. In addition, according to some computer teachers, there was some health hazard for teachers because the computers were not equipped with a special filter for electromagnetic lighting.

Most principals also mentioned the teachers' financial problems. For example, one of them said: "Another problem is the financial situation of teachers who do not have the patience to do such work". He went on to say:

Although teachers' salaries had been increased during the last year, still it is not enough for living expenses. Therefore, most of teachers have to work in more than one school.

The good teachers obtained their second job in a private school which could pay a higher salary than the public school, and devoted more of their time and energy to the higher paying position. According to the principals, "teaching in the public high schools is for teachers' rest. The teachers spent all of their energy in the private high schools and with their private students and they come to the public high schools to take a break".

Some of the computer teachers thought that students did not have enough motivation for the following reasons:

(1) Most of the students had learned about computers before in the KAD or in the private organizations. (2) The students were not sure how they could use the acquired knowledge from the Computer Studies course. (3) Questions from this course were not included in the UEE. (4) According to computer teachers, it did not seem that it was an important course because it substituted for the KAD and it was not included in the UEE. (5) This course was only about teaching problem solving and BASIC language and other applications of computers were not included. (6) Shortage of suitable software in the Persian language was another important factor affecting students' motivation for learning the Computer Studies course. The teachers said that students' English is not good enough to work with computers. Some teachers compared their skills in English to their students and said that during their education, the second language was English, but after the revolution it changed to Arabic. Therefore, most students are very weak in English.

In the pilot study, when the researcher had focused interviews with students from one of the girls' schools and one of the boys' schools, a large majority of students (in particular girls) claimed that they were very interested in computers before taking this course, but during the course they lost a lot of their initial motivation. They suggested some solutions for increasing
the students' motivation. The researcher included the students' suggestions in an additional question in the students' questionnaire to solicit other students' views (for more information see, Appendix A.6). For increasing the students' motivation, 78% of the students suggested that they should have more access to computers. About 65% of the students reported that the hands-on time on the computer should be increased, and 57% of the students reported that the computer should be taught before the high school level, namely in the Guidance level and during the Elementary level.

4.7 Participants' Attitudes toward Computers

In general, participants' participation in the program was different and depended on their attitudes toward computers. Although most principals in this study were positive toward using computers in various areas, they did not seem to involve themselves in the affairs related to the Computer Studies course. In a few cases, because of the parents' pressure, some principals were actively involved in establishing a computer lab (girls) or providing more facilities for computer labs. The principals were more concerned about using computers in administrative affairs than in teaching about computers. The majority of principals said that most bookkeepers did not approve of using computers in bookkeeping because they thought that the computer would take their places. Most of them wondered why they had to use computers. According to a majority of principals, the bookkeepers were against using computers for administrative purposes, because really they did not know what would happen with their jobs and what computers could do for them. One of the principals said "the human is afraid of the unknown; if they know they will not be so afraid". A few of the male bookkeepers in the high schools did not like to use computers for doing administrative tasks although they were compelled to do so. They thought that the computer made many mistakes, e.g. "from the time that paying salary has been done by computers, there have been many mistakes".

Female principals were more interested than male principals in using computers for administrative purposes. The principals who were more knowledgeable about computers and had used computers before, were more interested in providing more computer facilities. For example, one of the girls' principals, who was very interested in using computers and wanted to establish a computer lab but was not successful, said "to establish a computer lab is not an easy job, you have to have a lot of facilities, such as computers, software, teachers, suitable place, chairs, desks, electricity, maintenance, repair and so on" She said that for establishing a computer lab, a lot of support is needed. She said that she tried to use the parents' support for establishing a computer lab but it was not enough. She had to have the district's support too. Some principals (10) thought that community support was very important in the success of
implementation of any new technology. Following are extracts from parents’ interviews.
The parents in the study could be categorized in three different groups according to their attitudes toward computers: the parents who had positive attitudes toward computers, the parents who had negative attitudes toward computers and those parents who were indifferent.

Positive Attitudes toward Computers: A majority of parents (70%) had positive attitudes toward computers. They wanted their children to learn about computers, in particular their older children, because they thought that if the older children learn about computers, they would transfer that knowledge to the other children. Most parents in this study pointed to the UNESCO slogan. This slogan states that people who do not know about computers are illiterate.

Through interviewing parents, it was found that parents with higher education were more positive toward computers and were more interested in their children’s learning about computers. Although most parents who had positive attitudes toward computers were literate, there was also a parent who was illiterate and had positive attitudes toward computers. She said: “I am illiterate and blind but my children have to learn in order not to be like me”.

According to one of the parents, “this period of time is child centered”. The first and the most important priority for parents was their children’s education. They sent their children to different classes to learn different skills. One of the policy makers who had studied the social sciences said that the Iranian people have changed during the previous few years. He reported:

There are families who can hardly make a living, but they spend a lot of money for their children’s education. They put their children in different private classes: e.g. Music, Swimming, Computer, etc. They pay a lot of money for their children to learn a profession. Their rationale is that they did not have such possibilities, they want to provide their children whatever they did not have.

One of the parents who was a teacher said:

We did not have such possibilities that students have today. For example, I hadn’t seen a computer during my studies in high school and university. But my students use computers as toys. There is a big change. I feel ashamed in front my students. Their knowledge is more than mine. I am embarrassed when they ask about computers.

Some parents were willing to learn about computers, but they thought that it was too late for them, so they asked their children to learn what they liked. Another parent said that her family lived in England and told family members about a large variety of the computer
applications in her daughter's school. Her children knew how to work with computers. She said:

Our children should know about computers because in the near future, our country would need a lot of computer experts. So, the schools should teach about computers.

Many parents who had positive attitudes toward computers assisted in fund raising activities to purchase computers for their schools. In one of the girls’ schools, because of the principal’s interest in using computers, parents were particularly active in providing educational programs for high school use.

**Negative attitudes towards computers:** Six of the parents (20%) did not approve of using computers. These six were male parents. Only one of these six parents had a university degree, three had secondary school education and two had primary education or less.

A majority of these parents (5) were more concerned about UEE. They believed that the students’ fate depended on that exam. If they could pass this exam, their future would be assured. One of them said “I am wondering if the computer could help students to pass the UEE”. Three parents felt that their children should not take any computer courses before passing the University Entrance Exam. Most of the parents in this group, did not consider the Computer Studies course seriously and they thought the students were playing with computers. They argued that their children would like to spend all of their time playing with computers and it wasted their time. Three of the six parents also thought that using computers meant to be dependent on other countries. Two parents thought that computers made mistakes. The following are some of other reasons for these parents negative attitudes:

One of the parents, who was a retired Math teacher and had a bachelor degree, said that he had never let his students use a calculator. He said that the calculator made the mind very lazy. By using the calculator students could not think by themselves and they would be dependent on the calculator; it meant that if they did not have the calculator they could not even calculate very simple arithmetic. He was also opposed to using computers and thought that it was not good for countries such as Iran. Therefore, the students should not waste their time playing with computers and should invest their time in the subjects which were more important than computers. After he asked for the researchers’ opinion about using computers in education and after he heard how the computer could be used in different areas and how it could help students, he said:
Perhaps as you said it is important, but I graduated many years ago and I did not use it. I think that people need to know more about computers and what things are possible to do with them. Radio and TV have to produce more programs that show people different computers applications.

The above citation reflects the possibility of a change in attitude through increased awareness. Another parent who did not approve children’s learning about computers worked in an office as a bookkeeper. When the researcher asked him if he used a computer for doing his job, he was very surprised and asked why he should. He said that he did not need a computer because his mind was a computer. He said that he knew the place of every file better than the computer and he could retrieve any file in less than a few seconds. “So, why do I have to use a computer?” He did not approve of the computer and said that the computer would replace manpower and he did not like it. He said that it was not an important subject, and Iran did not need computers.

Indifferent parents: Three parents (10%) leave teaching about computers to the school and teachers to decide what is best for their children to learn. In the interview with one of these parents, she said that she did not know what was good for her children to learn. She said that it was the responsibility of the Ministry of Education to decide what was good for students and what was not. One of these parents was illiterate and two had elementary education. Most of them had a big family. In the interview with one of the mothers in this group, she said; “the most important problem for us is to feed them”; she also said that her husband did not even know what grade his children were in. She had eight children.

4.8 Effects of the Computer Studies course

This section includes the views of the people who were directly more involved in this course, namely teachers and students. All interviewed students said that taking this course had positive effects. For example, one of the students said:

It was a new experience. During this course we had an opportunity to work on the computer. All the courses that I have taken before consisted of merely theory and some of them were very boring. It was also a new experience to work cooperatively.

According to the students, in this course competition did not exist and all students worked together. They shared their understanding with each other. One of the students said that she met her best friend in the computer class.
Students argued that in other classes there was a great deal of competition among students and if they solved a problem they would not show the answer to the other students. But in this class, they were not competitors but friends and peers. They learned to work cooperatively in this group. All students in the group tried their best to solve the assigned problems without thinking of other things. The relationship between teachers and students changed in this class, too. One of the students said:

We have learned that the teacher is not the only source of knowledge and that teachers could make mistakes too. In other classes, we have not seen a teacher say, “I do not know” and this is another big change in the culture of the classroom.

In working with computers they benefited from the knowledge of other students, especially the ones who had taken private classes. Another important change was in the teachers’ teaching style.

4.8.1 Teaching Style

For comparing the teaching style in the Computer Studies course with other classes, the researcher had a chance to observe some of the math and theoretical computer classes, too. In these most theoretical classes, the teachers’ emphasis was on the syllabus. The teaching strategies included lectures accompanied by examples and other explanations by the teacher. The most common activity of students during the teachers’ lecturing was note-taking. In interviews with students, many complained that in many cases they did not understand how the teacher came up with the answer. Most students listened passively to the teacher or other students who solved the problem on the blackboard, without challenging the answer or expressing different views. However, in the hands-on computer class observations, three kinds of teaching styles were observed: traditional, semi-traditional and non-traditional.

**Traditional:** Some teachers and, in particular female teachers, did not give any freedom to students. The students had to enter the data of the given problem into the computers, and if they had any questions they had to raise their hands and ask the teacher for help. One of the female teachers said “I use the same strategy that I use in mathematics teaching. I teach the lesson and students solve the problems”. One of the female computer teachers said that she established rules for students such as not leaving their desks, not talking, and not using personal diskettes. In the girls’ observed classes, the students were allowed to work only on the given problems from the syllabus. If students asked questions outside of the syllabus, teachers would say: “we do not have enough time to work on such questions which are outside of the syllabus.” or “please, do
not take class time with questions outside of the syllabus”. In these kinds of classes, more knowledgeable students often caused trouble for teachers, e.g. by not obeying the rules, unplugging the computer, etc.

Semi-Traditional: Some of the boys’ teachers and one of the girls’ teachers were more open minded about giving freedom to students in the computer classes compared to the first group. Students in these classes could move from their chairs and go to another computer desk to see their peers’ work. The teacher still kept an eye on what was happening as the students moved. The teacher controlled the tendency of students to gather around the computer. In the interview with one of the teachers about his control over students he said:

One reason for control over students’ work is to see what they are doing with the computer, as sometimes students bring game software to the classrooms. If we do not check the students’ activities, it will lead to more general lab disturbance and the other students would not be able to use their time efficiently.

In two boys’ classes, students were free to move and watch other students’ work, but they were not allowed to make any noise. According to the teachers, students were obliged to obey some rules such as being quiet and not bringing any personal software.

Non-Traditional: In the non-traditional group, a big change was observed in the role of teachers, from a teacher directed approach, to the role of facilitator, or a co-learner. In three of the observed hands-on classes (2 public and 1 private), students could make mistakes and learn together. The students were working cooperatively, and instead of competing they worked with each other to solve the problems. Therefore, the interaction between students increased and their friendships blossomed. Furthermore, the relationship between teachers and students has also changed. The students learned that the teacher was not the only source of knowledge and he could also make mistakes. Two of the computer teachers reported that at first they thought that it was wrong to make a mistake in front of the class. Gradually they learned to work with students to solve some problems without being afraid of making mistakes. One computer teacher, who had a computer science bachelor’s degree said that this was a big change in the relationship between teachers and students. Students in the observed classes had more freedom to ask questions. After doing their homework, they could bring some educational software or games and share them with other students. One of the computer teachers said that students were more motivated to finish their homework and do other things outside their syllabus. “Students are glad because they can do other things which are less boring and I am happy because I learn new things from students, too”. Three students in this class were writing a program in Azari
language; another group worked on a program for administrative purposes. The teacher helped and encouraged these students and sometimes he stayed with them after the class. In these observed classes, students were more active and they expressed their creativity by writing new programs.

In general, although some teachers had altered their style of teaching, others, perhaps due to age and academic background, had not. One teacher, who had a math degree and 15 years teaching experience, said that although it was good for teachers and students to be more friendly, he was personally uncomfortable with this and preferred to maintain a distance. Another former math teacher felt that he could not change into a computer teacher:

I think that I am not a computer teacher, even though I know more than the syllabus, but I think it is unfair that I am a computer teacher. I was a math teacher for fifteen years. I see computer as math, the problems that I give to students are math problems. At first they should solve the math problems. I say to myself that they are not learning math, but at the end all of the problems are mathematical.

He commented that the students who were very knowledgeable about computers could identify the computer parts very well but they could not solve the math problems. He knew that his approach to teaching the computer course was not liked by his students, as they complained that even their friends who studied computer science in university could not solve the problems he gave them, but he said “math is in our blood, with the disposition that math teachers usually have and still have”. His solution was to have only teachers with computer science degrees teach computer courses, leaving math teachers free to teach math. He felt that computer use was detrimental to the study of math:

A computer is useless, even a calculator. I do not let students use a calculator and if I see that they have it I will break it. They can use it at home, not in the school. The calculator does not permit students to think for themselves and makes them lazy.

4.9 Implementation Problems during the First Year

According to the policy makers, one important problem in the first year of implementation was the shortage of computers. According to Mr. D., “In some provinces, because of the increasing number of students and increasing price of computers, this problem still exists. Insufficient budget is still a crucial problem”. The shortage of trained teachers was another problem mentioned by the policy makers. For example, Mr. D. said “at this time, we do not have this problem as much as in the first years, but we still have it”. Other changes are as follows:
Supervision of the Computers: According to Mrs. C., during the first and second years of implementation, the Bureau of Curriculum Planning was supervising the Computer Studies course program. Mrs. C. stated:

This bureau was responsible not only for planning the computer book but also for executing this program and participated in all aspects of implementation, e.g. in purchasing and supervising the computers and in establishing the computer labs and other facilities. This Bureau was charged with teacher training, too.

In response to the question “how was the cooperation of the educational administrators in the provinces?” Mr. D. said “we purchased the computers and facilities and trained the teachers and there were no reasons for the province administrators to resist”. He said that in the provinces people were very active and concerned about computer course. They researched the problems and tried to solve them. Their cooperation was excellent; if they did not have enough teachers, they trained them by themselves. Mr. B. said:

In the first year, we established one lab in each district, but there were schools which bought computers by using different budgets obtained through the district support or the parents’ support. We do not supervise the implementation process the same way as in the first year of implementation.

According to the policy makers, in the first year of computer implementation, they evaluated the program in some Iranian cities. They gave questionnaires to the teachers and according to their responses, some parts of the Computer Studies book were changed.

One of the principals who had a computer lab in his high school said that in the first year of the computer implementation, they had an electricity problem. “The electricity power was not enough and we had some electricity supply problems, but now we reinforced the electricity, we changed the school’s electricity to 3-phased, and from that time we have not had any electricity problems”. He said that during these years, they had made some changes in the computer labs, such as establishing networking. “we have changed the benches and we had bought chairs and desks for students.” According to the principals who had a computer lab in their schools, more computer teachers were available compared to the first year. The number of schools which were equipped with computers had been increased. According to the principals, although some problems which existed in the first year had been solved, other problems had emerged, such as problems related to the maintenance.

In the interviews, the teachers reported that they have experienced loneliness, alienation,
fears in different degrees, especially in the first year of the computer implementation. One of
the computer teachers in the boys’ high schools reported that the fear of computers which existed
in the first year of teaching the Computer Studies course was greatly reduced during the
following years of implementation. He emphasized that this fear has not gone totally, but it is
reduced, in particular when he encounters students who are more knowledgeable than he. About
other feelings such as loneliness, teachers reported that they were the first teachers who taught
about computers in their high schools. There was no guidance for them. They felt loneliness
when facing problems. In the first year of implementation, there were a few Computer Studies
course teachers. Because of the small number of trained teachers, they were busy with teaching
in different schools, and they did not have any opportunity to discuss the new technology with
other Computer Studies course teachers. The number of computer teachers had been increased
and they had a weekly meeting to discuss and share their common concerns, thoughts and
problems with each other. The computer teachers said that they have had more opportunity to
participate in the in-service courses which were arranged by the Board of Education and they
were more knowledgeable compared to the first year of teaching the Computer Studies course.
They thought that their teaching styles have changed because of using computers. They said that
in the first year of teaching computers, they gave less freedom to their students. They tried to
manage the classes in the traditional way and the syllabus was the only source of students’
knowledge. The knowledge of the principals and the districts’ administrators has been increased
compared to the first year. They had participated in different classes and they are more
knowledgeable than in the first year. The computer labs were not ready in the first year and the
electrical and cable connections for the computers were incomplete. The majority of the
computer labs did not have a lab manager.

Another problem in the first year of the implementation was that teachers were not sure
about the continuation of this course. In the following years teachers felt more secure about the
stability of the course. The same situation existed for principals who used computers for
administrative affairs. They were not sure about continuation and thought that the use of
computers in countries such as Iran was a wave that over time would be diminished.

According to the head of the Teachers’ Association and some of the policy makers,
teachers enthusiasm was the most important factor in overcoming many difficulties which
existed during the first few years of implementation. They accepted that in implementing any
new program, there were many problems and they should be patient.
4.10 Future of Computer Education In Iran:

According to policy makers, in recent years the private schools got equipped with computers and they were going to use computers at different levels. One Ministry official said that private schools did not have trained people and also they did not have a plan for using computers. They did not know what they should teach at different levels. All of the private schools and also private tutorial organizations were using the Computer Studies course book as a model and they taught the same material. All the private high schools are teaching about BASIC as a computer language in their extracurricular programs for different levels.

According to Mr. F., the real problem in teaching about computers was that only a few people knew about what should be taught. He said that most of the decision makers and planners did not have any idea about what materials should be included about computers at the different levels of the educational system. Some of the policy makers suggested that data processing and retrieval of information should be taught to students in different levels.

4.10.1 Introducing the Computer Studies Course to Other Majors:

According to the policy makers, the Iranian educators were planning to establish a new computer literacy course in all areas of high school education. According to Mr. G. teaching about computers in the Elementary and Guidance levels was also a future plan of the Ministry of Education. He stated:

Of course, a lot of money should be invested for carrying out this project. The problem is that now we are encountering a population crisis in the high schools. The number of students in our high schools is going to double, because of the increase and growth of births in the revolution years. If we solve this problem, we will invest more money in other fields such as computer education.

It should be noted that in the new educational system, students in the other branches of the high school would be able to take the Computer Studies course as an optional course in the post-diploma, pre-university level. In this version of the course the application of computers was to be more emphasized and less emphasis would be placed on programming and on Math aspects. According to the author of the new computer book, data processing was one of the important subjects in this course.

4.10.2 Integration of Computers in the Curriculum:

Some of the policy makers believed that curriculum planners should review the curriculum and make essential changes according to the development of technology. They thought that the Iranian educators could acquaint students with computers through different
subjects, for example, in science when speaking about the weather, an example of computer use in this field could be presented by a video, a picture or a trip. For example; Mr. A. argued:

For this purpose, we do not really need to have computers. But the culture and the meaning of the computer and its application should be considered. We teach science in our schools, but how many students have access to experimental instruments?

Mr. F. had similar ideas. He said that they could teach about computers in the Elementary and Guidance school. However, they could not include the Computer Studies course in the elementary curriculum, because there were not enough facilities, in particular in small cities. Mr. F. said:

The curriculum planners said “when we do not have a computer, how could we teach about it?” and my response is perhaps we do not have telephones in some places or some homes, but we have to teach about the telephone and its role in human life. We should add something about computers in the curriculum, such as what a computer is and what it can do.

Some of the policy makers believed that for integrating computers into the curriculum, they need to have trained teachers. For example, Mrs. A. said that teachers from other subjects need in-service training to be able to use computers in their teaching and to be able to integrate computers with curriculum.

Other groups, in particular principals, thought that computer education in Iran depends on the political situation. For example, because Iran was not a producer of this technology and had to import it from other countries, its import would depend on many political conditions. One of the principals gave an example of the US economic boycott on Iran. In that case, Iran had to acquire much US equipment with maintenance from other countries at a much higher price. In the case of computers, the political situation determines from which country they should have the computers. In addition, the amount imported depends on the exchange rate of the dollar.

Most principals thought that not only did the world political situation impact computer use, but also the local political change would effect computer use. They said that usually when the Minister of Education changed, not only most people who had a high position would be changed but sometimes even the district administrators and principals in other provinces would be changed. Those changes would have an effect on many decisions and policies. For example, if the people who were making the decision in the Ministry did not feel a need for using computers any more, they would not invest in this field and they would advocate more budget for building schools or training teachers. These factors caused many people, especially principals, to
be pessimistic toward many innovations and think of them as temporary, leading to reliance on short term planning. This issue will be discussed in the following chapter.

4.11 Summary of Findings

In this chapter, the process leading to the introduction of computers into the Iranian high schools was described. The rationale for introducing the Computer Studies course was presented, both from the policy makers’ and other participants’ points of view. The most important findings of the present study are:

- Most teachers and students were unclear about the objectives and expected outcomes of the Computer Studies course. In addition, this course was not included in the university entrance exam (UEE). This caused a lot of confusion, because participants did believe that teaching/learning about computers was important.

- All different groups in the present study thought that the use of computers in education was a complex innovation that needed a lot of support. High expectations of the computer teachers made their job difficult for them. The tasks demanded of them were in many instances in conflict with their customary ways of doing things. One of the unintended outcomes of this course was that some teachers changed their way of teaching, from the traditional, teacher centered approach to student centered, facilitative approach.

- The main source of support was the Ministry of Education. Community support was also important in establishing more computer labs. In spite of the Iranian centralized education system, availability of computer related resources varied considerably among various districts. Most principals did not participate very actively, especially in the schools which had computer lab managers. Computer-educated principals were more active in having additional computer facilities and gave more freedom to teachers for using computers. Contrary to the assumption at the beginning of the study that the private schools would use computers for teaching/learning in a variety of ways, such as CAI and application programs, the results indicate that these schools, like the public schools, used their computers only for teaching computer literacy courses.

- Shortage of hardware and software was a barrier in using computers. Access to school computers was limited to hands-on time on computers during classes, which was insufficient. In the districts with more computer labs, two students were working with each computer. In other districts with larger class size and a relatively small number of computers, 3, 4, and sometimes 5 students were working with each computer. Insufficient computer memory, lack of technical
support, the high cost of repairs and lack of maintenance were important inhibitors to the use of computers. A small number of computer teachers and students had access to home computers. Access to recent resources such as journals, books, conferences, and the Internet was limited or even impossible.

- Very few CAI programs were available in the schools, and those few that were available were in English and imported from other countries. The imported programs were inappropriate to the Iranian culture and curriculum. In addition, there were hardly any applications programs available in the schools.

- Most principals, lab managers and teachers of other subjects in the present study had not received any computer training during their university training. The computer teachers were the only group that had received pre-service computer training and the majority of them had also received the in-service training. All groups expressed a need for more in-service training related to computers. The in-service programs available did not meet the staff needs. Most participants in the study complained about having been taught only BASIC programming in their in-service training courses.

- Gender issues in using computers: Average number of hours of access to home computers per week: Significantly less for girls than for boys. Sixty five percents of boys, compared to 17% of girls had previous knowledge about computers. The reasons for this difference were:
  - Boys could take computer courses in their KAD apprenticeship, but girls could not.
  - There were more learning opportunities outside of school for boys compared to girls, e.g. computer courses in non-profit organizations. Parents were sending their boys to private computer classes more often than their girls.
  - Boys had more time to spend with computers at home. Parents expected more household chores and help from their girls compared to boys.

- A majority of teachers perceived large variations in the student's computer knowledge as a serious problem in teaching the Computer Studies course. Students who came from families with a higher socio-economic level were more knowledgeable about computers and had more access to computers at home and schools. Male students had more access to computers and also were more knowledgeable than female students. The girls who came from families with a higher level of education were more positive and more confident about their computer knowledge.
Most participants in the present study thought that computer education in Iran was only a temporary innovation because of the political situation. This is one of the few qualitative differences between the situation in Iran and in North America.

The findings of the present study indicate the importance of situational factors of Iranian society such as socio-economic and socio-cultural factors, as well as the political situation, in the computer implementation process.

In the next chapter, these findings will be discussed in comparison with other research studies, and Fullan's model of computer implementation will be extended, so as to better represent the factors that are particularly important in developing countries.
CHAPTER FIVE

DISCUSSION

Throughout the world there is a continuous (albeit quite unequal) development of access of schools to computers, increasing numbers of teachers/students are using computers for instructional purposes. Despite this development there is still a lot of inequity in access to computers, even in highly developed countries, and educational practitioners feel that a number of basic conditions for using computers for instructional purposes have not yet been fulfilled (Pelgrum and Plomp, 1991, p. 12).

The chapter starts with an overview of the process of introducing the Computer Studies course into the Iranian educational system, and then discusses the factors that influenced the process of implementation, using Fullan’s model as an organizational framework. The additional factors for adapting Fullan’s model to the study of technological changes in the school environments of developing countries are addressed in this chapter. The findings of the current study are also discussed in light of other research from both developing and industrialized countries.

5.1 Introduction

This investigation consisted of an exploratory study of the introduction of computers into Iranian educational system. Participants in this study were samples of different groups involved in the innovation, namely policy makers, principals, teachers, students, parents, and lab managers. The collected data included questionnaires, interviews, policy documents and on-site observations of various kinds of Iranian high schools in Isfahan. The high rate of the questionnaire returns and interview participation demonstrated the participants’ interest in cooperating to improve computer education in Iranian high schools.

The findings of this study indicate that the most important use of computers in the Iranian educational system was teaching the Computer Studies course (CSC). Computers have also recently been used in administrative tasks. Findings also indicate that very few teachers of other subjects used computers at all. The reasons for not using computers will also be discussed in this Chapter.

The above findings confirm other research studies in developing countries, in particular, the results of a comprehensive survey of educational computer use in developing countries conducted by Hawkridge, Jaworski, and MaMahon (1990). The most important educational use of computers in Iran, just as in other developing countries, was to teach about computers.
Teaching BASIC was one of the most important uses of computers in these countries. Similar results were found in a survey of 18 industrialized countries by Brummelhuis and Plomp (1991). The survey indicated that despite the increasing number of schools equipped with computers and the increasing number of computers available in schools, in “most educational systems computers still are used by a limited number of teachers, and mainly for teaching students about computers; the integration of computers in existing subjects is increasing quite slowly” (Brummelhuis and Plomp, 1991, p.10).

The most important problems in using computers in Iran, as in other developing countries (Hawkridge, Jaworski, and MaMahon 1990), were: shortage of hardware and software, lack of trained people, lack of financial support for maintenance, lack of clarity about objectives and motivational problems. Brummelhuis and Plomp (1991) found some of the same problems in their study of 18 industrialized countries. Note that the Brummelhuis and Plomp (1991) research was conducted in 1989, and computer use in industrialized countries may have been further developed since then.

Since the most important use of computers in the Iranian educational system was teaching the Computer Studies Course, the process of introducing the CSC into the Iranian educational system will be first discussed.

5.2 The Processes Leading to Introduction of the Computer Studies Course

As figure 5.1 indicates, the initial motivation for introducing the Computer Studies course(CSC) was caused by information about the world wide spread of computers presented to the Iranian middle and upper class people both by Iranian media and by relatives living in the west. This knowledge about the widespread use of computer technology led to Iran’s feeling that it would never ‘catch up’ with the west until it could produce a computer literate society.

The upper and middle classes reacted to this worry in two ways. They bought computers for home and business use, enrolled themselves and, more importantly, their children in private computer courses, and they put pressure on the school system to provide computer education for their children. One of the beliefs held by parents was that in order to find a job in the near future, their children should know about computers. This pressure, combined with the spread of computers in Iranian society, resulted in long and rigorous discussions in the Iranian Ministry of Education. Finally, in 1987, the Ministry of Education in Iran recognized the need for teaching about computers and established a Curriculum Committee to develop a program for computer literacy (the policy makers’ rationale for developing the CSC was described in Chapter Four). The process leading to the introduction of the CSC is presented in Figure 5.2.
Figure 5.1

Initial Motivation for Innovation

1. Spread and Use of Computers in the World

2. Information Received by Middle and Upper Class from different Media and Relatives who live Abroad

3. Feeling of Being "Held Back"

- Buying Computers
- Participating in Private Classes
- Trying to use Computers

4. Spread of Computer Knowledge

5. Putting pressure on school Administrators
Figure 5.2: Process Leading to a Curriculum Change and its Implementation: The Computer Studies Course in Iranian High schools

1. Need Recognition
2. Exploratory Activities
3. Research and Development
   - Inviting Iranian scholars in computer field
4. Inviting Computer activities in different countries
5. Participating in Olympiad computer competition
6. Examining Objectives
7. Curriculum Change Initiation
8. Curriculum Design Setting Objectives Textbooks
9. Pilot Study
10. Evaluation
11. Initial Implementation
12. Teacher Training
13. Provide Hardware and Software
14. Change the Textbook
15. Write Circular
16. Establish Computer Labs
17. Implementation
In order to introduce the Computer Studies course into the Iranian educational system, research on educational computer use in both developing and industrialized countries was conducted. In addition, a number of computer labs in different countries were visited by the people on the Computer Committee. Participation in the Olympiad exam was also considered important for planning. Based on this initial research, the Computer Committee established the objectives of the course. The most important objective for teaching this subject was to develop problem solving skills. The short term plan was to teach about computers only in one high school grade. The long term plan was to teach about computers to students in all high school levels. Due to the small number of students in the Math and Physics branch compared to other majors, this group was chosen for the short term plan.

Computer scholars from different Iranian organizations and universities were invited to write their proposals for the Computer Studies Course. The best proposal was chosen according to the established objectives. The necessary hardware and software were purchased by the Ministry of Education. The Math teachers who had taken computer courses during their university training were the ones selected. Inservice training courses were arranged in order to train these teachers. In 1991-1992, a pilot project was started in the central cities of 25 provinces. After evaluation of the pilot project, the essential changes were made in the computer textbook. Essential resources were provided and this course was extended to all of the students in grade 11 of Math/Physics in 1993-1994.

The introduction of this course had the same advantages as the computer literacy courses introduced in North America during the 1970's and early 1980's.

First, it answered the call from parents to do something to prepare their children for a world in which computers were becoming increasingly important. Second, it provided a way for schools to get involved with computers without making a substantial capital investment. Computer literacy courses could be managed with a small number of not very sophisticated or expensive machines. Third, computer literacy could be handled by teachers who were computer novices themselves. (Kurland and Kurland, 1987, p.323):

All decisions related to providing the resources and getting teachers ready to implement the course were done by the center. Havelock's model (1973) 'Research, Development, and Diffusion' is a highly organised approach mostly used as a model in developing countries. In the 'bottom-up' approach advocated by some educators/researchers in industrialized countries (e.g., Means, 1994), implementors (teachers) initiate the innovation and motivate the principals and administrators to support the innovation. The 'bottom-up' however, is impossible in many
developing countries, because of highly centralized budgeting and bureaucratic decision making (Bishop, Clark and Grant, 1991, p.322).

Bishop (1986) thought that this 'top-down' approach is a good model for developing countries in which people in the lower level do not have a high level of knowledge and information. However, according to Bishop (1986), even for developing countries, there are two serious disadvantages in the top-down approach to innovation: (1) Implementors are not involved in the development process of the innovation. They are passive recipients of changes. (2) "Because of the high degree of centralisation, local needs and variations are often neglected" (Bishop, 1986, p.17). As will be discussed later in this chapter, not being involved in the decision making process will cause some ambiguity about objectives and outcomes.

5.3 Implementation

The main focus of the present study was on implementation issues in using computers in the Iranian educational system. Factors affecting successful implementation included in Fullan’s model of computer implementation (1988, 1992) are used as guidelines in discussing the findings, in order to find out to what extent these implementation factors emerged in the current study of introducing computers in Iranian schools. These findings will be discussed in relation to other research concerning both developed and developing countries.

In this section, first the factors which are included in Fullan’s model will be discussed. Some other factors which are especially important in developing countries and which Fullan’s model has not specifically addressed, will be discussed later in this chapter. Recall that the factors in Fullan’s theory consist of: (1) Factors related to the characteristics of the innovation. (2) Local conditions.

5.3.1 Factors Included in Fullan’s model

The findings of this study confirm the importance of factors related to the characteristics of innovation identified by Fullan (1992) in the success of the implementation. Following are the findings of the Iranian study related to the characteristics of innovation.

5.3.1.1 Factors Related to the Characteristics of Innovation

Clarity of Objectives: According to Warwick, Reimers and McGinn (1986), innovation is successful when the people who are going to implement it understand its purposes and have enough motivation to do it. Findings of this study indicate that some teachers and students were
unclear about the objectives of the Computer Studies course. They thought that if this course was about computer literacy, it should not be restricted to students in grade 11 Math and Physics and if the objective of the course was to teach problem solving and Mathematics, the problems and the content of the course should not be so different from other Math courses. The students thought that problems in their computer book were unrelated to their Math books and also to their real life. Some teachers and students compared this course to other subjects which continue from year to year and from elementary to secondary, while this course does not. Therefore, the discontinuity of this course was another reason for the lack of clarity about objectives.

The parents whose children went to private schools also said that most of these schools were equipped with computers but they were not used. The objectives of having computers in the private schools were unclear for most parents. In the interviews with the private school principals, they said that they did not have any idea about what should be taught about computers in different levels of schools. In interviews with policy makers, they also did not have any answers to the above question. Policy makers articulated only two simple goals: (1) to teach about computers (computer literacy course) and (2) to integrate computers into the curriculum. They appeared to lack a clear view of what results they expected as outcomes of the curricular change.

In addition, some people such as the lab managers were unclear about their job responsibilities and asked for job descriptions. In a research study that took place in Kenya by Makau in 1990, uncertainty over the role of computer managers was also reported “This uncertainty was a major barrier to the dissemination of the innovation at the school level” (Makau, 1990, p.120).

Quality of Innovation: As mentioned above, the main goal of this course was to develop students’ problem solving skills. According to some of the policy makers and other administrators, the results of the Computer Olympiad competition demonstrated that this course had achieved this main goal. In the researcher's opinion, this could not be an acceptable way to evaluate the outcome of this course, because the students who participated in the Olympiad exams were the very small chosen number who had a high problem solving capacity. In addition, these students were chosen after passing different exams. The chosen students were taught the Pascal language, too. Finally, teachers never reported that their students were demonstrating better problem solving skills in other areas such as Mathematics. According to Fullan (1992):
Innovations are more likely to get implemented and stay implemented when they result in visibly improved student outcomes. Thus the chances for successful change are greater ...when at least some of the benefits for students are immediately apparent to teachers (p. 36).

Complexity of Innovation: The introduction and use of computers in education is a very complicated and complex innovation (Ragsdale, 1994; Ragsdale, 1988; Means, 1994, Fullan (1989, 1992) which “requires the fulfillment of a large number of conditions before any success can be expected” (Plomp & Pelgrum, 1991, p. 250).

All the different groups in this study thought that the use of computers in education was a complex innovation. Policy makers thought that using computers in education was a very complicated innovation because it needed a lot of investment in different areas such as technology and experts. In addition to providing essential hardware and software, which mostly should be imported, training teachers and other staff to implement computer use was another important issue which should be considered seriously. Principals and lab managers also thought that establishing a computer lab was a complex job. It needs a lot of resources such as space, hardware, software, electrical outlets, desks, chairs, supervision, repair and maintenance. Moreover, using computers needs trained teachers. Teachers from other subjects thought that considerable preparation is needed for using computers in education. In addition to teacher training and availability of hardware and appropriate software, big changes in the syllabus are also necessary. In the researcher’s view, changes in teachers’ attitudes and teaching style are the most important and difficult part of the change. In some of the observed classes, teachers were lecturers, and students were good listeners. Cooperative learning and discussions were observed very rarely. Using computers requires changing the teachers’ role from lecturer and source of knowledge to facilitator. This change will require some training. The computer teachers in this study thought that teaching computer studies was more complicated compared to teaching other subjects because of the following reasons:

- Rapid progress in the computer field needs ongoing training. It would cost both time and energy.
- A computer teacher should have expertise in many different fields such as Math, Computer Science, and English.
- Managing the Computer Studies classes, in particular the hands-on practice on computers was very difficult compared to other theoretical classes.

Consensus: “The prospects for successful implementation are greater when those expected to carry out a change agree on the need, on the appropriateness of the innovations selected, and on
the priority of the change effort relative to other local concerns" (Fullan, 1992, p.34).

As the results of this study indicate, the decisions related to this innovation were made at the top. Regarding the consensus of the administrators in the Board of Education in other provinces, one of the policy makers said, "we purchased the computers and facilities and trained the teachers and there were no reasons for the province administrators to resist". The Ministry officials said that the administrators in the Boards of different provinces were very active, researched the problems and tried to solve them. However, no mention was made of whether these provinces approved of the innovation; this was taken for granted.

Most principals agreed with teaching about computers. They thought that all students and teachers had to have some knowledge of computers. A majority of principals from private high schools arranged a computer literacy course as an extra-curricular subject for students in other branches.

The findings of this study showed that computer teachers felt a need for this course. In addition a large majority of students felt a need to be trained about computers. Careful examination of the information about the number of students who had taken computer courses as an optional choice for KAD and the high rate of students’ participation in different private computer classes revealed the students’ and parents’ interest in learning to use computers. Furthermore, according to the policy makers, they put this course into their curriculum to attract more students to the Math and Physics branch.

5.3.1.2 Factors Related to the Local Conditions

Some factors of local conditions in Fullan’s model which were consistent with findings of the Iranian study will be discussed in this section.

"Implementation should be based on a plan. In this plan, attention should be given to ongoing budget requirements, replacement materials, training new personnel, supervisory and support " (Fullan, 1992, p.41). Providing ongoing services requires different types of support; not only support from the Ministry but also from other groups. In the following section, different kinds of support will be discussed.

Support for Innovation: Support is very important in the successful implementation of any innovation. According to Ragsdale (1994, p.23), "Pressure plus support has been the watchword for the implementation of computers". Ragsdale went on to say that “most of the teachers and
some of the students are aware of the pressure, but few of them are aware of substantial support. Without such support, the impact of computers on education will be minimal” (p.23). Other research pointed to the importance of support in the innovation (Fullan, 1990, 1992; Ely, 1990; Jo, 1996)

Any individual who is about to try a new material or procedure wants to know that there is support from a higher level (Chapman, 1990). This is not blind commitment, but firm and visible evidence that there is endorsement and continuing support for implementation. (Ely, 1990, p.302)

Support could be received from both inside and outside of the educational system. The results of the present study indicate that not surprisingly, the most important source of support was from the Ministry of Education. Most equipment in the public high schools was provided by the Ministry of Education. In-service teacher training was arranged by the Ministry of Education and usually consisted of a brief introduction to the different parts of computers and teaching the BASIC language. Boards of Education and districts were two other sources of support, but this was so sporadic as to be non-existent. Different groups in this study asked for more support in providing resources: hardware, software, in-service training courses, technical support and more learning activities such as arranging seminars, conferences, and communication with experts in this field.

The present study found that even though the educational system is centralized in Iran and all schools are supposed to have the same resources, there were different levels of computer facilities because of varying levels of support. This issue will be discussed later, in the section on availability of computer related resources.

**Community Support:** The results indicate that the districts that received more support from students’ parents had more facilities compared to the other districts. The results confirm Fullan’s theory about the importance of community support for successful implementation. Interested parents pushed the Board of Education and the districts to undertake some projects and they could themselves provide financial support. In addition, if parents support the change, the administrators “are more likely to make it a priority, apply pressure and commit resources”(Fullan, 1992, p.51). In this research, the community support was important in the establishment of more computer labs. Some of the schools had even used the parents’ support for writing administrative software. The role of community support will be discussed further in the section of ‘Factors of Computer Technological Change’.

**Principal’s Leadership:** Findings of the present study indicate that only a few principals were active and supported their schools in providing more facilities or establishing a new lab.
According to these principals, it was difficult but not impossible to persuade district administrators and parents to establish a computer lab or buy more facilities for the labs. Findings of this study also indicate that the principals’ ability to persuade the district administrators and parents depended on the principals’ computer knowledge and the extent of their exposure to computers. The principals who had computers and worked with them were more interested in having more facilities. The principals’ knowledge about computers was also very important in the teachers’ and students’ access to computer labs. The principals who were more educated about computers gave more freedom to teachers and even students to use the computers. They also corresponded many times with districts to arrange in-service training courses for the school staff. Therefore, the principal’s commitment to getting more facilities and their communication with parents and district administrators was essential.

In many cases, principals did not participate very actively, especially in the schools which had computer lab managers. Since they had computer lab managers, these principals did not assume much responsibility. Another reason may be that they thought the computer lab did not only belong to them but was shared by many schools.

**Problem Solving and Monitoring:** The findings of this study indicate that the Ministry of Education supervised the implementation process by providing inspectors to monitor and problem solve during the first year of the program. During the first year of implementation, the program was evaluated and essential changes were made in the CSC book. Unfortunately, this monitoring did not continue during the following years of implementation by the Ministry of Education. Therefore, even if many problems which existed in the first year of implementation were reduced or resolved in the subsequent years, many of these problems did not manifest themselves seriously in the first year of implementation, only in subsequent years. Monitoring and problem solving should have been continued throughout the duration of the program.

**Staff Development- Ongoing Training:** Many experts identified the importance of teacher training in the implementation of computers as a major reason for its success (Fullan, 1988, 1991, 1992; Ragsdale, 1988; 1991, 1994; Dugapne and Krendl 1992; Sebastiani, 1985). Burke (1987) and other specialists in the computer field showed that without trained teachers, the results of any computer program “will be disappointing and progress in making increased instructional use of computers will be painfully slow. With well trained teachers, progress is rapid, even in light of inadequate hardware and software, and courseware” (Moursund, 1979, cited by Burke, 1986, p.33).

Teacher training is probably the greatest bottleneck to the successful implementation of
computers in education in developing countries. According to the literature, at the center are teachers who frequently find themselves with the primary responsibility for executing the implementation of computers in the classroom (Carey & Carey, 1984; Dalten, 1989).

According to Hawkridge, Jaworski and MaMahon (1990), "almost all teachers using computers in developing countries were never trained to do so during their initial training, and they have had only the briefest of in-service courses relating to computers" (p.201). According to the literature, one problem in almost all of the developing countries was inadequate teacher training strategies. Furthermore, only the teachers who taught computer courses received training; others have not received any computer training. Many of the issues discussed above are also relevant to the implementation of computers in the Iranian educational system. For instance, the computer lab managers should meet some special criteria and have specialization in management and computer science. But according to their interviews they did not have any computer background and they had no idea why they had been chosen for this job. Most of them complained that they did not have a job description and they argued that they did not have enough knowledge to do their jobs. For example, one of them said:

If I have to have responsibility for the computer lab, first I should have the essential knowledge and then I could be responsible. Unfortunately, we are given the responsibility without essential knowledge.

Compared to many other developing countries, Iranian computer teachers had received more computer training. Most computer teachers had taken computer courses during university and the majority of them had also participated in the in-service computer training courses. Still, they needed more in-service training for the following reasons: First, computer technology is complex. Second, the rapid progress in the computer field requires ongoing training in order to keep current. Third, many of their students had taken numerous computer courses and already knew a lot about computers. Students had more time to practice with computers compared to their teachers. This confirms the findings of other research. "Students currently are being given opportunities for regular, systematic instruction while studies indicate that most teachers do not have continuing instruction beyond inservice workshops" (Calfee, 1985 cited by Winnans and Brown, 1991, p.301). Another study by Smith (1987) indicated, that teachers showed significantly less confidence in their ability to use computers than did their students (Smith, 1987 cited by Winnans and Brown, 1991).

Some of the computer teachers suggested that the content of the in-service training be updated from the 1977 textbooks in current use, and that the content and outline of the training be made known beforehand so that teachers could prepare themselves. The computer teachers pointed out that the Board of Education subscribed to few journals which often arrived very late,
and that access to foreign journals was limited due to foreign currency problems. Teaching BASIC in all in-service training courses was also criticized by all participants. They suggested that teaching BASIC did not meet their needs.

In the researcher’s opinion, having continuous training is very important but must be complemented by ongoing access to computers. If the teachers participate in the in-service courses but have no opportunity to practice their newly acquired skills with the computer, they will most likely forget what they have learned. Access to computers is essential, as is ongoing training through more in-service training. Communication with fellow computer teachers and with other computer experts is also highly desirable. In addition to using internal resources (e.g., workshops and inservice training), the Ministry of Education could use external resources such as television and other media (this had been the experience of other countries such as France, and Canada). According to Fullan (1992), “TVOntario runs a popular introductory course by television called ‘Bits and Bytes’. One of the ministry officials interviewed reported that about 20,000 teachers had registered for that course since it was first offered”. The role of the media in different groups’ computer knowledge will be discussed later in the section on socio-cultural factors.

The results of the study also indicate that other groups of participants needed more computer inservice training. Not only did the groups who were involved with computers ask for more inservice training, but even teachers from other majors were eager to learn about computers. Principals also complained about the shortage of computer inservice courses. This study shows that the teachers and principals who had computer experience were more positive toward computers and wanted to learn more about them. These results confirm the results of other studies (Koohang, 1987; Woolsey, 1985; Dupagne and Krendl, 1992). “The level of enthusiasm about computer use increases with the individual teacher level (-) of computer experience (Koohang, 1987, cited by Dupagne and Krendl 1992).

5.3.2 Situational Factors of Iran (Developing Countries)

This section introduces an extension of Fullan’s model which include factors typical of the situation in developing countries. These factors are: (C) Perceived value of specific curriculum change, (D) factors of computer technological change, and (E) factors of traditional societies in transition. The extended model of implementation in developing countries is shown in Figure 5.3. The reader should note that some of these factors are partially covered by one or more categories in Fullan’s model but are not focused on as separate categories. In the case of developing countries, these factors play a central role and deserve to be separately considered and discussed.
FIGURE 5.3: FACTORS INFLUENCING IMPLEMENTATION

Fullan Model Factors

(A) Characteristic of the Innovation
1. Clarity and Complexity
2. Consensus
3. Quality of Innovation

(B) Local Conditions
4. Central Office Direction, Commitment and Support
5. Process for Implementation and Institutionalization
6. Professional Development and Assistance
7. Implementation Monitoring and Problem-Solving
8. Principals' Leadership
9. Community Support
10. Environmental Stability

Situational Factors of Iran (Developing Countries)

(C) Perceived Value and Expectations Of Specific Curriculum Change

(D) Factors of Computer Technological Change
(i) Computer Resources
(ii) Technical Support and Trained Staff Availability

(E) Factors of Traditional Societies in Transition
(i) Socio-Economic Factors
(ii) Political Situation
(iii) Socio-Cultural Factors

OUTCOMES OF IMPLEMENTATION
5.3.2.1 Perceived Value and Expectations of Specific Curriculum Change

The factor is related to, but distinct from Fullan's characteristic of innovation "Quality and Practicality". The following issues indicate the importance of the perceived value and expectations of the Computer Studies course, by the people who were involved in the implementation of computers in the Iranian schools.

What is considered to be very important in Iranian society is being admitted to the university. The efforts of all educators were evaluated according to their students' results on the university entrance exam (UEE). Because the Computer Studies course was not included in the UEE, this course was not an important factor in the teacher assessment. Similar results were reported by other researchers of developing countries (Hawkridge, Jaworski and MaMahon 1990, Jo, 1996; Molnar, 1981). Teachers of computer studies in China, for example, thought that they had low status because their subject area was not part of the university entrance exam. According to a survey from Korean schools by Jo (1996), "about one-quarter of high schools in the sample reported that they have never received such support from their principals. This may be because the major interest of high school principals is in the preparation for the college entrance examination above anything else" (p.201). In Kenya, "some parents are worried when they find their children becoming too engrossed, and they ask teachers to dissuade them from continuing, particularly in the last year at school, before the national university entrance examination" (Molnar, 1981, p.27).

Some of Iranian teachers and students were not sure about the outcomes of the course because this course was not included in UEE. Some students declared that they had to study other subjects which were included in the UEE and after being admitted in the university they would have more time to learn about computers. Some students said that teaching about computers should be included in the Guidance (intermediate) curriculum, because students would have more time to learn about it. This important issue will be discussed later in this section.

Although the vocational rationale was given by parents as the most important reason for learning about computers, in the planning of this course, this rationale was ignored by the policy makers. Teachers and students thought that this course would not help students find a job. In addition, some students claimed that their expectations of this course were not met in reality; for example, some of the students complained that they did not even learn how to format diskettes. Some girls who had no access to computers for a few months declared that at the beginning of the course they were happy that they had a practical course 'not purely theory' such as their other courses. But after some time they were disappointed because it was so boring. These students
concluded that this course was not so different from other theoretical courses because of the shortage of hands-on time on computers.

**Motivation:** According to teachers, not considering the computer studies course as part of the UEE not only caused students and their parents not to pay any attention to this course, but also caused lack of financial incentives for teachers, compared to teaching Math. In teaching Math, teachers could make extra money by being private tutors, because Math was included in UEE, but the CSC was not. The complexity of teaching the CSC compared to other subjects caused some computer teachers who were interested in computers at the beginning to become frustrated and discouraged. Therefore, they asked to change their position from computer teachers to Math teachers. Following are some of their reasons:

- High expectations of computer teachers made this job difficult for teachers. In addition to teaching the Computer Studies course, everybody expected them to know a lot of other computer tasks. For instance, troubleshooting in case of technical problems, installing programs and guiding the students' parents in purchasing computers, arranging workshops for different groups in the districts, and preparing guidelines and outlines for the other extra-curricular computer courses have all become another part of the computer teacher’s job. Computer use for administrative tasks made additional demands on these teachers; most of the time they were asked to help the book-keeper and the principal. Extensive information from radio and television about computer applications made for high expectations of computers from society, and, in particular, students and their parents. The students expected to do in the computer classroom some of what they had seen or heard through these media. Similar expectations of computer teachers were also reported in other developing countries (Hawkridge, 1990a; Makau, 1990).

- Some students were more knowledgeable than their teachers because they had already participated in many computer classes. Computer teachers in these classes were not the only source of knowledge anymore. Therefore, in addition to changes in teachers’ behaviour and attitudes, big changes happened in relation to the teachers’ status in the classroom.

- At the beginning, the computer teachers’ perceptions were that by learning to teach computer courses, they could make more money from private students, but this never happened. They also argued that in teaching math, teachers could make extra money during their free time, but in teaching the Computer Studies course they could not, because:

  Professionals in the field of computers are more knowledgeable people than we are and they can teach about computers better than us, so there are hardly any
private classes for computer teachers, and on the other hand, we need math teachers more than computer teachers because of the spread of math. Even in the farthest places in Iran, they have math in their curriculum but they do not have the Computer Studies course. In addition, the Computer Studies course is not included in the UEE (an interview with one of the computer teachers).

Some of the computer teachers had expected more recognition from the Ministry of Education and asked for more incentives such as financial incentives, reduction of teaching load, including the CSC in UEE.

Other researchers also discussed the importance of incentives in computer implementation. For example, Jo (1996) in a study about computer use in Korean schools reported:

Over 96% of the schools in the sample had never reduced the teaching load of those who are responsible for computer use in schools. This may be indicative of the disappointment and frustration of teachers....There is a clearly great need for administrative support providing strong incentives toward computer use in schools (Jo, 1996, pp.201-203).

Although the Ministry officials believed that the Computer Studies course should be included in UEE, they could not implement this because the decisions related to including questions from CSC are made by the Ministry of Higher Education which is independent from the Ministry of Education. More cooperation between these two Ministries (Ministry of Education and Ministry of Higher Education) is essential for the success of any educational innovation in the Iranian system. In addition, according to students and teachers this course would not help students to find a computer-related job.

As for student motivation, teachers thought that there was not enough motivation for students to learn about computers because this course was not included in the UEE. However, only one third of the students reported that they did not have enough motivation to learn within the Computer Studies course. There were reasons why some students did not have enough motivation for the Computer Studies course:

Most students (especially boys) had learned the BASIC language during their KAD instruction or in the private organizations and they had expected to learn something else about computers. In addition, they were not sure how they could use the acquired knowledge from the Computer Studies Course. They believed that this course could not help them to find a job more easily. Moreover, this course was only about teaching problem solving and BASIC
programming, and other applications of computers were not included. Shortage of suitable software in Persian was another important factor affecting students’ motivation for learning the Computer Studies Course.

Although teachers thought that in order to motivate students, the Computer Studies course should be included in the UEE, students did not think so. Only a small percent of students thought that for motivating them, questions from the Computer Studies course should be included in the UEE. Perhaps, the reason why students did not want the Computer Studies Course included in UEE was that they thought they were not good enough in this field, so if this course were to be included in the UEE they would not get a high grade. In addition, they would have to prepare themselves for an extra course for UEE.

Some students suggested that in order to motivate students to learn about computers, at first students would begin with some game programs at primary school level. After getting used to the keyboard, they would be taught programming. Some students suggested that Graphics should be included in the Computer Studies Course syllabus. Some suggested color monitors instead of black and white.

The students who were very good in programming said that the best reward for them was to see the result of solving a problem. Most students from both genders said that computers were intrinsically motivating. They said that they enjoyed working with computers and asked for more access to computers. According to the students’ questionnaires, for increasing the students’ motivation in the Computer Studies course, 78% of the students suggested that they should have more access to computers. About 65% of the students reported that the hands-on time on the computer should be increased.

In summary, for increasing the students’ motivation the most frequently mentioned incentive was having more access to resources. As the results indicate, access to resources depended on many factors. This will be discussed in the following section.

5.3.2.2 Factors of Computer Technological Change

The factors discussed in this section are partially covered by the characteristic “Quality and practicality” of Fullan’s model, and by the Local conditions “Central office direction, commitment and support” and “Professional development and assistance”. However, since these factors are largely magnified in developing countries and also include other aspects specific to developing countries, they deserve to be identified and discussed in a separate category.
Factors of computer technological change include: (i) Computer resources and (ii) technical support and trained staff availability.

5.3.2.2.1 Computer Resources

Access to computers is considered essential for the success of computer implementation. "The availability of hardware and software is an important necessary condition for the introduction of computers in education" (Plomp and Pelgrum, 1991, p.251). Other studies (e.g., Ely, 1991; Radsdale, 1988, 1993; Winnans and Brown, 1992) identified the importance of having access to computers during the implementation process. Leasure (1994), in a study about computer education in the Soviet Union, concluded that the biggest problem in using computers was the lack of hardware.

The review of literature in developing countries indicates that the development and acquisition of software is more crucial than the purchase of hardware. According to the literature, little software is acquired in developing countries for two reasons. First, available money is spent mainly on hardware, and second, it is felt that just having computers will cause children to be computer literate (Hawkridge, Jaworski and MaMahon 1990). Most software acquired is in English and/or is culturally inadequate.

According to Hawkridge (1991a), in developing countries, despite the desire of governments to adopt computers in the schools, many barriers remain, such as heavy customs payments on imported hardware and software. Another issue is that when foreign manufacturers succeed in supplying computers to developing countries, as donations or at discounted prices, these same manufacturers and their local agents show little interest in after-sales support.

The present study has also found the above mentioned problems in the Iranian situation. Lack of computer access was considered a major problem by teachers and students. A large majority of teachers and students mentioned that the hands-on time on computers was not enough. The findings also indicate that even in the centralized Iranian educational system, the access to computers depended on the socio-economic factors. This will be discussed in the following section.

Students' Access to Home Computers: Although the majority of parents in this study expressed their interest in having a computer at home, the results indicate that only a small percent of students had access to home computers. A majority of these students came from homes with either a high level of income or a high level of education. The results of this study also indicate
that the Iranian parents who were more educated and had more computer experience were more positive toward computers and were willing to have a computer for their children's use at home. Unfortunately, most of these parents could not afford the high price of computers. Therefore, most of these parents tried to put their children in private classes so they would have a chance to learn about computers.

In total, Iranian students did not spend much time on computers at home during the week. The results showed that the boys used home computers more than the girls. The average number of hours of computer use per week for the girls was less than that of the boys. For girls, the average was about 2 hours, while the average for boys was about 3.5 hours. It was also found that students who had computers at home were not using them to a great extent. There were various reasons why students did not use the home computers as much as they liked: lack of interesting software, lack of time because of the immense volume of the syllabus, lots of homework, many exams and parents' pressure to be accepted in the UEE. This study also indicated that the most important home computer use by students was for games and entertainment purposes. Games and entertainment were the most commonly used by the Iranian students at home. According to Ragsdale and Durell (1994), "Much of the experience that students have with computers is acquired out of school and comes in the dominant form of computer games. Using computers to fill in time with no curricular aim will likely promote the strong tendency that students already have of seeing computer use as game playing" (p.17).

The results also indicate that the girls used the computer for games and entertainment purposes more than boys. In contrast, research in other countries (e.g. Ragsdale and Durell, 1994) has indicated that boys used computers for games more than girls. This may be explained by the fact that there were fewer entertainment opportunities for girls in Iran. Boys have other entertainment opportunities such as sports, or going to the cinema and theater with their friends. But girls go out only with their parents and have less opportunity to spend time with friends. The other reason may be that the boys were more familiar with computers or more knowledgeable about computers compared to girls, so they used them for more advanced activities. This issue will be discussed in relation to socio-cultural factors and gender issues.

**Students' Access to School Computers: Social Inequities:** The results from the sample of high schools indicate that school access to a computer lab varied a great deal in different types of schools. Private high schools and exemplar public school each had a separate computer lab. The labs in these two types of schools were used for teaching the Computer Studies course to students in grade 11 Math and Physics and a computer literacy course to other students. Students
in the other branches of these schools could take computer literacy as an extra-curricular program. The private school labs had more powerful computers than the public schools. Most computer teachers in the private high schools had a computer science background. Teachers in the private schools were paid more. Therefore, they had a higher incentive compared to other computer teachers in the public schools. The difference in the access to computer facilities was also observed among the districts' public high schools. The findings indicate that there were different levels of access to computers in various districts. For example, two districts had one computer lab which was shared by boys and girls. The people in these two districts had a lower socio-economic level compared to other districts, and though the number of students in this district was larger than in other districts, the number of Math and Physics students was smaller. There was only one shared computer lab for both genders.

The two other districts had a separate computer lab for boys and girls. One of these two districts had four computer labs. The people of this district had a higher level of income compared to other districts; therefore they support their children's schools in providing more computer facilities. It is worth mentioning that most of the private schools were established in this district.

In the districts which had more computer labs, two students were working with each computer. In schools which had larger class size and a small number of computers, 3, 4, and sometimes 5 students were working with each computer. According to the researcher's observation a majority of students were not familiar with keyboarding and had to spend a lot of time finding the right key. Therefore, to have 3 or more students on one computer was most ineffective. In many classes observed, one student who was more fluent with the computer, dominated the computer and did not let the other students work with the computer. This was observed many times by the researcher, particularly in the girl classes. The findings of the study confirm the findings of Becker's National Study in 1986. According to Becker, the adoption and use of computers indicate that socio-economic status (SES), the number of computers, and the amount of access time, affected the use of computers in schools. He found a relationship between school SES (as measured by parental income) and the student: computer ratio. "Schools with high SES had more computers than low SES" (Becker, 1986, p.2). To sum up, there were large variations in computer access even among the students in the Computer Studies course.

The present study also found that a large majority of students in public and private high schools did not have permission to use the computers after school hours. There were no written guidelines preventing use of computers by students, but worries about damage and lack of
supervision meant schools did not allow student use after school hours. For the large majority of students the only access to school computers was the hands-on practice hours, during the school day, which according to the majority of students was insufficient, in particular for the students who had not taken the computer courses before.

**Teachers' Access to School Computers:** The results indicate that in only a few public high schools did teachers have permission to use the lab computers for instructional purposes after the school hours. No teachers from private schools had such permission. This study also found that the large majority of teachers in all kinds of high schools were not allowed to use computers for professional purposes e.g. report cards. Not even one of the private high schools allowed teachers to use the computers for their personal purposes. In the interviews with the principals of the private schools, the most important reason given was the high expense of computers and the principals' fear of damaging or breaking these precious things. It would appear that in different types of schools, the principals' educational background and personal interest in computers were the key factor in the development of the computer use. The more educated principals were more positive toward computers and gave more freedom to teachers and students to use computers.

Most computer teachers complained that because they did not have enough access to computers at schools, they could not try out the solution to most of the problems on the computers. The teachers should have access to computers to be able to solve the problems and answer the students' questions. The teachers also might want to try out some educational or application software. In order to have more knowledgeable computer teachers, there should be free access to the computer labs.

The location of computers was another problem for teachers' access. According to the computer teacher interviews, access to computers was easier for teachers who had a computer lab in their schools. In particular, booking time for computer use in these labs was easier because the teachers were more familiar and friendly with the principals and lab managers. This is an important factor as in many cases there were no written guidelines, and personal contact was necessary.

**5.3.2.2.2 Technical Support and Trained Staff Availability**

Technical problems with computers were another important issue in teaching the CSC. The majority of teachers pointed to the existence of different technical problems and reported that sometimes one or two computers were out of service for a few months. They suggested that there had to be one computer expert (resource person) in each district, to be responsible for the
maintenance of computers and to help teachers in case of technical problems.

Although some computer labs had a computer lab manager, unfortunately, this person usually had little technical knowledge about computers. In a study of computers in Kenya, by Makau (1990), he reported that the media co-ordinators “were uncooperative and unwilling to help other teachers” (p.120). In contrast, in the Iranian case the lab managers were very cooperative and willing to help students and teachers but as was noted earlier, did not have enough expertise.

The existence of resource persons as an important factor in the success of computer projects has been discussed by other researchers. For instance, Ragsdale and Durell (1994) wrote about the importance of computer resource persons in a Toronto based project, recommending: “it would be beneficial for any school initiating a large-scale commitment to computer use, to have at least an extra commitment of technical support from the board level beyond what is normally provided for maintenance purposes” (Ragsdale and Durell, 1994, p.11). Therefore, one important way of supporting classroom teachers using computers is to provide them with a resource person who can provide the necessary help.

**Access to other Educational Applications and Software**. Nearly all high schools which had computer labs used the lab for teaching only the Computer Studies course. Only a few principals from public high schools reported that some teachers had used the computers for CAI purposes in subjects such as Math, Physics and in one case, Geography. The teachers who used computers for CAI purposes were from public high schools which had computer labs. There was no report of CAI use in the private and exemplar public high schools.

The researcher's assumption at the beginning of the study was that the private schools used computers for teaching/learning in a variety of ways, such as CAI or application programs. But the results indicate the opposite. There were many reasons why the private high schools did not let students and teachers use computers in various ways, other than for the computer courses. The most important reason was that the computers in the private high schools were provided from the budget of the high schools and so principals were worried about damage from additional hours of use.

Furthermore, the computer teachers and students had little access to any educational software. There were no CAI programs in the computer labs of the public schools. Only a small number of students reported that their teachers had used CAI programs, which were brought in
by other students. All groups complained about shortage of CAI programs, especially programs which were produced based on the Iranian culture and curriculum. According to the policy makers, the use of CAI programs in the curriculum was never seriously considered by the Ministry of Education.

Regarding the use of application programs, the only application software which existed in a few computer labs was word-processing. Only one computer teacher used a word processor. There was no report of using application programs such as spreadsheets, databases or communication packages. It seems that except for a very few cases where teachers reported the use of other programs such as graphics or games, most computer teacher activities were concentrated on the Computer Studies course. Most teachers had no experience with application programs themselves, so they could not teach their use to others.

5.3.2.3 Factors of Traditional Societies in Transition

These factors consist of the following: (i) Socio-economic, (ii) political situation, and (iii) Socio-cultural factors. These factors of traditional societies in transition, especially socio-economic and socio-cultural factors, are not dealt with in Fullan's model of computer implementation (1988, 1992).

According to McGee (1987), "past research on innovation has largely ignored the social context in which implementation occurs" (p.189). In Fullan's model, conditions for success of implementation are defined without considering variations in the social context. In order to apply this model to the Iranian context, it needs to be adjusted. Social context of a given country should be considered. This will be discussed in the following section.

5.3.2.3.1 The Role of Socio-Economic Factors

As findings of the present study indicate, the socio-economic status of families was an important predictor of students' knowledge about computers. Students from higher socio-economic levels had more access to computers in their homes and schools. Various studies confirm the role of socio-economic factors in the success of implementation (e.g. Becker, 1986; McGee, 1987). A study by Lockheed (1985) in the United States, for example, indicates that "richer schools bought more equipment and more expensive equipment for instruction, African-American students had lower access to computers than did White students, and girls used computers in and out of schools less than boys" (cited by Sutton 1991, p.475). These results confirm the results of other studies. A study by Jay and Willis (1986) indicates that the
population of higher education and income has the most favorable predisposition in regard to the computer (cited by Winnans and Brown, 1991). Another study by Martinez & Mead in 1988 indicates that poor children had less access to home computers, and that "High school students whose parents had graduated from college were three times as likely to own a computer than students whose parent had not completed high school" (cited by Sutton 1991, p.477). According to Morris (1988-1989), "those who were better educated, whether young or old, were more favorably disposed to rapid advances in technology" (cited by Winnans and Brown, 1991, p.301).

In the present study, a large majority of the teachers perceived large variations in the students' computer knowledge as a serious problem in teaching the CSC. The large variations in students' knowledge were caused by the varying levels of student access to computers. In general, the students who came from families with a higher socio-economic level were more knowledgeable about computers. These results confirm the results of other studies.

In almost all developing countries, access to computers is usually limited to class hours, except that some schools also have computer clubs to which students can go at other times by reservation. According to Hawkridge, Jaworski and MaMahon (1990), in most of the developing countries there is no equal opportunity for using computers by all, and computer education is for rich people or it is only for boys (for more information see Tables 2.1 and 2.3 in Chapter Two, Literature Review). Jegede and Okebukola (1992) in their study of Nigerian schools pointed out that "students with low socio-economic status are disadvantaged in their exposure to and knowledge about computers in comparison to those with high socio-economic status" (p. 332).

The majority of participants in the current study pointed to the high expense of providing computers and other peripherals. Because Iran is not a producer of this new technology, computer equipment needs to be imported from other countries. This largely depends on the economic situation, the exchange rate of the dollar and the income from export. In addition to providing the hardware and software, the maintenance of computers is also expensive. Other research from developing countries also pointed to the economic problems in using computers (Hawkridge, 1991a; Marshall, 1990, Wali, 1983).

The literature review indicated that not only are the economic barriers the most important problem in developing countries but this is reported in some industrialized countries, too. For instance, Chomienne (1988), in a case study of using computers in the province of Quebec in Canada, reported:
In summary, the present economic context makes the implementation of the computer in the school systems difficult. Resources are limited, good courseware is scarce, equipment is incomplete, institutional support is deficient (Chomienne, 1988, p. 89).

The socio-economical situation of countries depends on many factors. One important factor is the political situation.

5.3.2.3.2 Political Situation

This factor partially overlaps with “Environmental Stability” of Local Conditions in Fullan’s model. However, the political situation factor includes not only the influence of changes in internal politics but also the effects of the world politics (external politics). Following are some examples:

Past experience had shown that with any change in the political situation, most administrators and principals had been changed. The findings of this study confirm this belief. (1) After the Iranian revolution (1978) most of the people who had management positions were forced to retire or to return to other jobs such as teaching or bookkeeping. (2) Most of the people currently in the managerial positions were assigned these positions after the revolution. (3) As the results indicate, 80% of the principals had less than 10 years management experience. Not only big changes such as revolution, but even small changes in the Ministry of Education might result in major changes in the administration of Boards and Districts of Education and principals. With these changes, many policies are also entirely or mostly changed. Havelock and Huberman (1978) in a study about developing countries report:

Problems which various experts found serious were ‘changing governments makes it more difficult to maintain consistent policy and to follow plans’ (p. 225).

In addition, for the success of any innovation, the people who are involved in implementing the innovation should feel that their jobs are secure and stable, which in turn depends on the political situation. If they do not feel secure in their jobs, they tend to think of the short term goals and ignore the long term investments or plans. The use of computers in instruction is a relatively new change that needs both short term and long term plans. In the case of Iran, the short term plan was to implement the Computer Studies course, and the long term plan is to integrate computer use in the various disciplines.

Furthermore, changes in the political situation will also cause changes in the amount and kinds of hardware and software purchased. On the other hand, any change in the political
situation might also cause changes in the exchange rate of the dollars which in turn might have an impact on computer purchases. Most principals in the present study stated that computer education in Iran depended on the political situation. For example, because Iran was not a producer of this technology and had to import it from other countries, its import would depend on many political conditions such as the US economic boycott on Iran. In that case, Iran had to acquire much US equipment with maintenance from other countries at a much higher price. In the case of computers, the political situation determines from which country they should import the computers. In addition, the amount of import depends on the exchange rate of the dollar.

Most principals thought that not only did the world political situation impact computer use, but also the local political change would affect computer use. They said that usually when the Minister of Education changed, not only most people who had a high position would be changed but sometimes even the district administrators and principals in other provinces would be changed. Those changes would have an effect on many decisions and policies. For example, if the people who were making the decision in the Ministry did not feel a need for using computers any more, they would not invest in this field and they would advocate more budget for building schools or training teachers. These factors caused many people, especially principals, to be pessimistic toward many innovations and think of them as temporary, leading to reliance on short term planning. Most teachers in the present study were not sure about the future of this course.

It is important to note that some major political changes might even have an impact on socio-cultural values, particularly as the Iranian revolution evolves. However, this topic is outside the scope of this thesis.

5.3.2.3.3 Socio-cultural Factors in Access to, and Use of Computers:

Culture is the attitudes, beliefs, values, and practices shared by a community of people which they often don’t question, are often unstated and which they may not be consciously aware of (Weissglass, 1992, p.195).

The results of the present study indicate that Iranian socio-cultural factors had an impact on students’ access and knowledge about computers. According to Makrakis (1992), “the culture and the society which one lives in seems to be of greater importance in determining one’s attitudes towards computers more than other factors” (p. 275). The findings of this study indicate that social beliefs and parents’ expectations caused gender related biases toward computers. This will be discussed in the section on gender issues.
5.3.2.3.3.1 Language

One of the most frequently mentioned culture related problems involved the language and curriculum content of imported software packages. The language of most educational programs was English. Although Iranian students had to pass some English courses during their Intermediate and High School years, still most of them pointed to the problem of software being in English. They said that their English was not good enough to understand many commands in English. They also pointed to the English used in CAI programs. Some students said that they had bought some chemistry and science programs but because the programs were in English they were not as useful as they had hoped because they did not understand all the content. Furthermore, the content was not according to their Iranian syllabus. They claimed that the use of those programs was a waste of time. Most teachers also recognised that the imported programs were inappropriate to the Iranian culture and curriculum, especially in social science and humanities.

According to Venter and Blignaut (1996), in a study of South African schools, “Language ability was identified as being the most important factor contributing to the success rate of students” in the computer literacy course (p.28). Language is a big problem in countries such as Tunisia where students had to use English software in spite of the fact that the first and second languages in this country are Arabic and French (see Table 2.2 Chapter Two, Literature Review). In China attempts have been made to introduce computers that can deal with Chinese characters (Hawkridge, 1990b).

According to Hawkridge, Joworski and MaMahon (1990), most developing countries do not use imported programs because of the cultural bias inherent in the software. “Yet there is virtually no educational software written and published in the third world” (Hawkridge, Jaworski and MaMahon 1990, p. 251). The culture of software imported from industrialized countries is quite different from that of developing countries and according to Galvis (1987), educational technology transfer can be a path for amplifying the cross cultural diffusion processes, which may weaken local cultures. Hebenstreit (1984), described the cultural issues related to the imported software as follows:

The first difficulty is a possible lack of efficiency of the packages due to the misadaptation between the content of the packages and the general background of the user. The other difficulty is a more subtle one and perhaps a less visible one. The educational system of a country is the place where national culture and traditions are transmitted to the young generation. Willingly or not the educational software designed in a country carries with it, in many subtle ways, the social and moral values of the culture of that country and therefore the massive use of educational software designed in a foreign country will slowly but
inevitably lead to a transformation and eventually to a decline of the originality and specificity of the national culture and traditions (pp.20-21)

As was discussed, one of the most important problems of developing countries in using computers is the cultural problems of imported software. The best way of avoiding cultural bias is to produce programs in developing countries, and this needs expertise to produce the software. One of the universities' responsibilities is to consider this important issue in their future planning.

5.3.2.3.3.2 Cultural Factors: Gender Issues

It is a matter of grave concern that our culture is defining computers as pre-eminently male machines. Despite the fact that in every life computers are becoming ubiquitous, the use of the computer in education seems to be following the traditional lines of gender bias in society (Hoyles, 1988, p.1).

The findings of this study indicate that there was a difference between male and female students in regard to their knowledge of, and access to, computers. Male students had more access to computers and also more knowledge about them than the female students. Although the educational system in Iran is centralized and both genders needed to take the CSC as a compulsory course, there were still differences in the students' access and previous exposure to computers. In general, boys were more knowledgeable about computers than girls. Other researchers found that, in general, women feel less secure about their computer skills and “know less about computers (Durndell, 1987 cited by Reinen & Plomp, 1993, p.354). Previous research also has indicated that on average, male students have more computer experience outside of the classroom than female students (Sutton, 1991; Hess & Miura, 1985; cited by Fulcer & Schofield, 1995, p.215).

The reasons for the difference between boys' and girls' knowledge about computers in Iranian schools were:

- Boys could take computer courses in their KAD apprenticeship, but girls could not. Girls had to take cooking, sewing and family studies during their KAD instruction.
- There were more learning opportunities outside of school for boys compared to girls. Boys could learn about computers in many non-profit organizations and even computer stores. They could spend more time with their friends working with computers at home compared to girls. Most boys went to the other students' homes which had computers and they studied with each other, but this is not possible for girls.
Many more parents were sending their boys to private organizations to learn about computers compared to girls.

In addition, boys had more time than girls to spend with computers at home. Parents expected more household chores and help from their girls compared to boys.

The teachers who were teaching both genders stated that boys tended to be more exploring, in particular in the mechanics of the computers, while girls tended to be more task oriented. One of these computer teachers said "for girls we have to teach everything, even small details. Boys are more independent and do everything by themselves. Girls never criticize and accept things as they are". In the researcher's opinion, this is because of social expectations. Girls are expected to be obedient. They do not have independence to buy whatever they would like. Their parents decide for them even in important matters such as marriage. Although, this situation also exists for many boys, boys have more freedom compared to girls.

The findings of this study confirm the results of other studies that "gender differentiation is a product of the social construction that determines what models of correct behaviour are given to children of each gender" (Turkle, 1984 cited by Makrakis, 1992, P. 276). These models are usually given by teachers and parents.

According to the computer teachers, the difference between boys and girls in their learning style may be because of different ways of instruction and teachers' styles. The researcher's observations of the classroom indicate that boys had more freedom compared to girls. Another reason is that girls do have limited computer access. Research from other countries also indicates that girls have less access to computers within and outside of schools (Siann, Macleod, Glissov and Durndell 1990; Sutton, 1991; Duendell, 1987). The only resource for girls is the book, so they learn it very well.

The majority of participants in this study thought that both genders have to learn about computers in schools. Among the different choices, most principals, teachers and students chose hardware engineering and programming as the two most important choices for men, and programming and graphics were chosen for women (for more information see Chapter Four, p.93). According to the students, their parents thought that boys were more technical in their orientation and they therefore had permission to experiment with different things, but girls did not.

Men are seen as technically oriented and interested in 'how things work', while women are seen as artistic and less involved in practical matters: this may lead to male and female teachers serving as different role models with regard to working with computers, which may, in turn, lead to the continuation of the described

The girls who came from families with a higher level of education were more positive and more confident about their computer knowledge. They believed that there was no difference between them and the boys and so that they could do whatever boys could. Some girls from the district which had a low level of income and whose parents were less educated believed that there was a difference between them and boys. They believed that boys were better in technical jobs and their brains worked better in Math and computers. The reason for these beliefs was that in their families and among acquaintances, most technical jobs belonged to men. They rarely saw women in such positions. Some girls in this study declared that it was surprising for them to see a woman conducting research in this area (the researcher) and that it was a kind of encouragement for them to see that women could even go abroad for educational purposes.

In general, the Iranian culture, as in other developing countries, is male-dominated. Male parents make all decisions related to family. Most parents think that the priority for education is for boys. Although the majority of parents in this study thought that both genders had to learn about computers, they preferred to spend money on their boys’ education, in particular when there was only limited budget available. Some parents thought that the computer is a male job and only word processing is good for girls. According to Sutton (1991), the only computer related area in which girls outnumbered boys in high schools was word processing.

According to Baron and Nathan (1995), similar gender inequalities have been reported in Canada and Israel (Collis and Williams, 1989; cited by Baron and Nathan, 1995, p.348). There were also similarities between this study of Iranian students and a study by Makrakis (1992) of Japanese and Swedish students: “stereotypical impressions about perceptions in considering computer to be more suitable for males than females, and the belief that some one must be good or have a positive attitude in Math to do well in computers” (p. 281). These cultural factors had an impact on the community support of schools. Parents were ready to support the schools for their boys rather than their girls.

Changing these kinds of attitudes requires different types of support. The media could help in various aspects, such as focusing on the women who are working in technical jobs and who are as successful as men. The girls need to have female role models and this is the media’s
job. Different media could help in different ways. Some possible media contributions in this field will be discussed in the following section. Another way to achieve this, according to Voogt (1987) is to involve more female teachers as role models in computer education. As the data in this study indicate, because of the lack of female teachers in this area, two male teachers were teaching both genders.

5.3.2.3.3 The Role of Media in the Implementation of Computers

The findings of this study indicate that public pressure for educating about computers was very important in the initiation process. The most important factor in motivating the public interest was the news and programs from different media, especially television. In the parents' interviews, most of them said that they did not take any computer courses, but they had learned about computers from different media, especially by watching TV programs. A study of "Equity and Computers in the Schools" by Sutton (1991) discussed the role of media in persuading people to have computers. According to Sutton (1991), "Print and TV commercials suggested that students would not complete college without ownership of a personal computer" (p.478). So, "Middle-class parents raised money for the purchase of computers and pressured districts to provide access for their students" (cited by Sutton, 1991, p.478).

This study confirms the role of the mass media in community support linked with the political strength of motivated middle class parents. Radio and TV, especially in developing countries in which the majority of the population is illiterate, are very important in distributing information. These media could play an important role in stimulating the need and community support. Dieuzeide (1987), in a study of computer education experience in France, pointed out the role of different factors in the computer education process. He also pointed to the role of media in this process:

Although not always in full agreement, industry, the public authorities, economic and financial circles, families and the media have been involved at all stages in the introduction of computer science into education and its subsequent spread. (cited by Makau, 1990, pp.2-3).

In addition to pursuing the public interest, the media could play an important role in providing information and enhancing audience knowledge about computers in different fields. As the findings indicate, the knowledge of most people in this study came from watching TV or listening to radio programs. Most parents said that they did not take any computer related courses and their knowledge about computers was limited to what they had seen from TV or heard from the radio. People from other groups in this study, such as teachers of other subject areas, computer lab managers, principals, and students, also pointed to the role of the media in
enhancing their knowledge about computers. According to Hebenstreit (1984):

In many countries there are also efforts to disseminate computer literacy to the whole population. In the UK there is a very popular series at the television on computer literacy whose net outcome has been that over 100,000 British made microcomputers have been sold for private use in homes. Moreover different strategies are used in different countries to spread computer literacy in the public (microcomputers in airports, exhibitions and museums) (p.10).

According to the Director of TVOntario’s Distance Learning Division:

TVOntario has been working for the last 25 years with school boards, education faculties, teachers, parents, and students to bring technologies into the classroom. Before us, there was the National Film Board, and before that the blackboard and the crayon, and the paper and the pencil, and the book (Karakas, 1995, p.40).

The researcher, based on her experience as a TV producer and an evaluator of TV programs, is well aware of the media power in distributing information, motivating people to acquire new knowledge and in making changes in the public’s attitudes. Moreover, the Ministry of Education in Iran could have used TV as a supportive medium for providing staff development programs.

5.4 Outcomes of the Computer Studies course

While the intended goals of the present study were to explore the initiation and implementation phases of the innovation of computer use in Iranian schools, the findings also shed light on the outcomes of this innovation. In this section, some of the intended and unintended outcomes (Ragsdale, 1988, 1991) of the innovation as described by computer teachers and students in their interviews will be presented.

Intended Outcomes: As stated above, teaching the CSC had two objectives: (1) to familiarize students with computer use and limitations; (2) to develop problem solving skills through BASIC programming. According to the students’ and teachers’ interviews, the course had achieved its first objective which was to familiarize students with computers. In particular, this course was very useful for students who had no prior computer-related experience. They had learned some of the computer terminology and got acquainted with the keyboard and other computer parts and peripherals. As for the second objective of this course, the development of problem solving skills is notoriously hard to formally evaluate. But in their interviews, teachers reported little or no improvement in general problem solving skills among their students.

Unintended Outcomes: In the researcher’s opinion, the unintended outcomes of this course are at least as important as the intended outcomes. The students and teachers experienced something
new that they had not experienced before. According to the teachers, they confronted a new situation that was different from their long teaching experience. They learned that they had to change their traditional ways of teaching, namely their use of a teacher centered approach and being a lecturer all the time. They learned that they had to give some freedom to students to experience new things. The teachers learned that they were not the only source of knowledge in the class and in many cases, students were more knowledgeable than they were and they had to learn from their students. At least some of them learned to work cooperatively with students to solve various problems. The wall of pride was broken in this course. Some teachers could easily say “I do not know”, and “you can ask other students” but for others, the admission was more difficult. In such “practical” classes, students were not passive listeners. The criteria for being a good student had been changed. The best students were not the silent ones, not any more. Hence, the unintended outcomes were changes in teaching style and in the teachers’ role. Typical students’ statements were: “I am not afraid to work with computers any more”; “I understood that the computer is not thinking by itself, we are the ones who tell computers what to do”; “I experience the freedom in this class, if not perfectly, but to some extent”; “I could easily move to other desks and ask the other students my questions and even see what they were doing”; “I found my best friend in this course”. These statements indicate profound changes in the classroom culture. Students were no longer passively listening all the time.

In other, non-computer courses, Iranian teachers tend to use competition in the classroom in order to motivate the students. Each student presents himself (herself) as the best student, tries to hide his (her) knowledge from the other students, and is going to show off his (her) knowledge only in the “competition” stage, i.e. only on the exam paper. Students rarely share their knowledge. What is written in the syllabus is important to be memorized and be regurgitated in exams. Anything outside of the syllabus is not permitted during the classroom hours. In contrast, in the computer classes, some of the advanced students had written some new programs outside the syllabus. They could demonstrate their creativity in constructing their own knowledge. They did not depend on their teachers anymore. Some students learned that in many cases they could learn from their classmates and that the teachers were not the only source of knowledge. Sharing the knowledge among students and working cooperatively were the other unintended outcomes of this course. To what degree this course achieved the intended goals is a question that should be answered in future research. According to one of the students “it is the only lesson that we are not forced to memorize. The other lessons are very boring and I almost wait for the hours to finish but the hours never end. But in this course I do not get tired and I want to stay for many hours and work with computers and it is not boring”.

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In general, although some of the computer teachers had altered their style of teaching, others, perhaps due to age and academic background had not. For instance, one teacher who had a math degree and 15 years teaching experience, said that although it was good for teachers and students to be more friendly, he was personally uncomfortable with this and preferred to maintain a distance. Another former math teacher felt that he could not change into a computer teacher. He said “I think that I am not a computer teacher, even though I know more than the syllabus, but I think it is unfair that I am a computer teacher”.

He knew that his approach to teaching the computer course was not liked by his students, but he said “math is in our blood”, with the disposition that math teachers usually have and still have.

The issue of classroom computer use requiring a change in teaching style has received a lot of attention from educational researchers in the western countries (e.g., Carey, 1993; Carmichael, 1985; Cohen, 1987; Egnatoff, et al. 1988; Means, 1994; Ragsdale, 1988; See, 1994). It was found that some teachers experience a lot of difficulty with this change and require support through either special training that involves experiencing themselves as self-directed learners, within supportive learning environments (McDougall, 1997; Means, 1994; Ragsdale, 1988; Sandholtz, 1992, Young, 1993), or through mentorship and/or peer group.
CHAPTER SIX

CONCLUSIONS

This final chapter will endeavour to bring together and summarize the conclusions and major findings of the study. The first section discusses the factors specific to Iran and other developing countries which influenced the implementation of computer education, the second section includes the implications of the study and recommendations, and the final section includes suggestions for further research in this field.

6.1 Factors Influencing the Success of Implementation

This study investigated how computers were introduced into the Iranian educational system, the rationale for introducing computers, and most importantly, the implementation process. The first focus of the present study was on the salient elements involved in the implementation process, and the interrelationship and interaction among these elements. The second focus was on examining how these factors relate to models of implementation, particularly to Fullan's model of computer implementation, and to examine the strengths and weaknesses of his theoretical model as applied to the situation of Iran and other developing countries. Following are some strengths and weaknesses of Fullan's theory in the Iranian context:

The Fullan model was useful in identifying and describing the content and process of change, and includes the main elements required for studying a top-down approach to change of the type used in the Iranian education system, which is highly centralized.

Another strength of Fullan's theory is that various factors involved in implementation are not linear, but rather interrelated. The findings of the present study clearly illustrate this interrelationship among factors. For example, the factor of support for innovation includes support for training, which affected the availability of staff development, and, in turn, better trained staff more enthusiastically supported the innovation of computer education.

As pointed out in Chapter 5, all factors identified in Fullan's model emerged also in the present study. There were some extra factors, however, which seemed to be particularly important in developing countries, such as political, social, and economic realities of a given
country. In Fullan's model, conditions for success of implementation are defined without considering variations in the social context. In order to apply this model to the Iranian context, it needed to be adjusted. The adjusted model was shown in Figure 5.3 in Chapter 5. According to this model, three additional types of factors needed to be considered in applying Fullan's model to the Iranian context: (1) perceived value of specific curriculum change; (2) factors of computer technological change; and (3) factors of traditional societies in transition. These important factors are discussed in the following section.

6.1.1 Situational Factors of Iran (Developing Countries)

6.1.1.1 Perceived Value of Specific Curriculum Change

All people involved in the implementation, even those groups who are indirectly involved, e.g. parents, should have an understanding of the goals, values and practices of specific curriculum change. It is also important that "the goals, values and practices espoused by the designers and sponsors of the innovation match with the goals, values, and practices of the adopting unit" (Banya, 1985, p.154). The following results indicate that this kind of match did not exist in the Iranian situation. First, being accepted in the university entrance exam was a value of utmost importance for all students and their parents. Based on the results of this exam, teachers and principals were evaluated. The subjects, such as the Computer Studies course, which were not included in this exam were not considered important enough to invest time and energy in. Second, the parents thought that learning the Computer Studies course would help students to get jobs more easily, but the teachers and students did not think so. Third, although the main stated objective of this course was computer literacy and problem solving, teachers and students did not believe that these objectives were met. They complained that students did not have any opportunity to become familiar with different applications of computers. Practical hours were short and the students' hands-on computer time was only enough to enter solutions of the problems into the computers. In addition, the students thought that this course did not help them to develop their problem solving skills, because the problems in their computer book were unrelated to problems in their math book and also to their real-life problems. Fourth, the group whose belief was not given much consideration consisted of the teachers who had to implement the program. The tasks demanded of them were in many instances in conflict with their customary ways of doing things. Teaching the Computer Studies course required a change from a traditional, authoritarian, teacher-centered pedagogy to a more facilitative, student-centered pedagogy emphasizing cooperative learning. This change was particularly difficult for the large majority of computer teachers who had been math teachers, as math teachers in Iran are imbued with the mystique of teaching the most difficult yet most important subject. Little consideration
was given to these teachers' psychological distress upon having to give up status as the only authority in their class.

In the beginning, the computer teachers' perceptions had been that by learning to teach computer courses, they could make more money from private students, but this never happened. The above issues might exist also in industrialized countries, but to a much lesser extent. However, they loom large in the developing world.

6.1.1.2. Factors of Computer Technological Change

As was discussed in the Discussion Chapter, two related factors in computer technological change become crucial in developing countries: (1) computer resources and (2) trained staff availability. Following are some of the problems related to these factors in most developing countries.

(1) Computer resources: The importation of computers and other related peripherals is an important issue in almost all developing countries. Imported computers rapidly become obsolete, yet are so expensive they cannot be replaced easily. In the Iranian case, insufficient computer memory to execute many of the educational programs was reported by the computer teachers and students. Lack of technical support and the high cost of repairs caused broken computers to be out of commission for months.

Most developing countries are not able to produce educational software, so it has to be imported. However, using imported programs is not advisable for them because of the following problems: (1) The imported software is in English or some other language other than their own; (2) the cultural bias inherent in the software is inappropriate for their culture; and (3) there is a misadaptation between the content of the educational packages and the general background of the user (Hebenstreit, 1984). In addition, imported educational software does not usually cover the same syllabus.

(2) Technical Support and Trained Staff Availability: Also characteristic of many developing countries is the fact that the people who are assigned to some jobs do not have the necessary skills, for example, the computer lab managers in the case of the Iranian study. Investing in more staff development programs would save money otherwise wasted because of the lack of knowledge. Not having access to new educational resources was another problem which is characteristic of developing countries. For example, the teachers who participated in the computer in-service course mentioned that the book which was used in the in-service training
course had been published in 1977. Access to many recent resources such as journals, books, conferences, Internet was limited or even impossible. The high exchange rate of dollars was mentioned as an important problem in having access to many of these resources. Another problem in updating the staff knowledge was the long waiting time required to receive the ordered written materials.

Furthermore, the in-service programs available did not meet the staff needs. Most participants in the study complained about having been taught only BASIC programming in their in-service training courses.

6.1.1.3 Factors of Traditional Societies in Transition

Also novel in this study was the examination of the role of situational conditions such as socio economic, political situation, and socio cultural factors in the success of the implementation. That is, on the one hand the study tried to account for the salient elements of implementation, namely support, availability of computer resources, computer knowledge and staff development, and on the other hand, the present research sought the relationship between these factors and the situational condition factors. The findings on situational factors portray how the socio-economic, socio-cultural and political situations affected the availability of computer resources and computer knowledge.

As the findings of this study indicate, the socio-economic status of families was an important predictor of students' knowledge about computers. Students from higher socio-economic level had more access to computers in their homes and schools. This study also demonstrated how social values and Iranian culture affected students' knowledge about computers, and the related gender issue was explored. The results of the present study indicated that there were very large differences between boys and girls regarding their access and knowledge about computers.

Socio-cultural factors have not received much attention in other implementation theories and, in particular Fullan's model. The results of the study and others from different developing countries indicate the importance of this factor in the use of computers.

Political situation is an important factor in the success of implementation, especially in developing countries where governments and their officials have authoritarian traditions. Change of the political leaders and senior officials not only has effects on the socio-economic conditions of the society but also may have a profound impact on socio-cultural values, as in the
case of the Iranian revolution.

Another noteworthy contribution was the exploration of the role of mass media in different stages of innovation. Findings indicated that radio and television had a decisive impact on the public interest in computers during the initiation process. These media were the major source of information and knowledge of various groups, in particular, of parents. The media also have an important role in encouragement of community support. Mass media could change some of the cultural values, for example, presenting females in computer-related jobs (technical) as role models for girls. These media could help change the social expectations regarding both genders. Further research is recommended in examining the role of mass media in different cultures.

6.2 Implications of the Study

The present study has both general and specific implications. The general implications are discussed in this section; the specific implications are included as recommendations in the next section.

The first implication of this study for computer implementation in education in developing countries, and the Iranian educational system in particular, is, on the one hand, to make prominent the importance of the implementation process and, on the other hand, to clarify the most important factors in the process.

The study provides an opportunity to account for some of the more important elements for developing a viable implementation theory for developing countries. Secondly, the researcher found that certain characteristics of the Iranian situation were not emphasized or were left out of the theoretical assumptions of the more common models of implementation derived from experience in western industrialized countries. On the basis of this examination, the researcher formulates suggestions both for additional elements to be considered in developing theories of implementation and for measures to be taken by national authorities in developing countries for coping with technological change in schools.

The findings of the study indicate that the western models of implementation should be modified for developing countries. It was found that three important types of factors, namely perceived value and expectations of specific curriculum change, factors of computer technological change and factors of traditional societies in transition, should be considered in the theories of implementation for developing countries. The importance of socio-economic and
socio-cultural factors should not be ignored in future studies. The researcher believes that every country has its unique socio-political and socio-cultural factors, that is, its internalized values, beliefs and norms of behaviour which play a key role in the implementation of any innovation and which should be seriously considered. A number of new insights such as the role of motivation in the success of implementation were also examined in the present study.

The major contribution of this research is to confirm that even in the wake of a major religious and ideological revolution, such as that in Iran, the main factors required for successful implementation of school change must be taken into account in order to achieve success.

This study has implications for improving the Computer Studies course in Iran. Further, the findings of the present research are in line with the growing attention and concern in developing computer courses for students of other majors and integrating computers in the curriculum at various school levels.

The findings of this study could be useful (specifically) for a number of different groups, such as the Ministry’s officials wishing to improve the use of computers. Further, as schools increase their utilization of computers, educational decision makers need an information base of effective computer usage in schools. Effective school computer usage requires the careful development and implementation of policy. Through thoughtful policy-making and sufficient resource allocation, schools and teachers can expect positive outcomes from computer use in instruction. Data collected during these initial phases of computer use in Iranian high schools will provide the Iranian Ministry of Education with a direction for computer educational policy.

6.3 Recommendations:

The primary recommendation to policy makers and educators involved in the designing/planning of introduction of computers in schools in developing countries is that in the planning process, sufficient resources should be allocated in the light of requirements for successful implementation of change. Efforts must be made to provide sufficient funding for hardware and software in schools. The present study found that most participants reported insufficient computer access, often aggravated by delays in repairs and trouble shooting. Budgets should be developed annually to offset the cost of both purchasing and maintaining computers.

Educational software should be produced by local experts. Computer teachers, curriculum and experts should be encouraged to produce software packages in the local language.
because the culture of western countries from which software is imported is quite different from that of developing countries and according to Galvis (1987), educational technology transfer can be a path for amplifying the cross cultural diffusion processes, which may weaken local cultures.

The people who are involved in the implementation should have a clear idea about what they are expected to do and should be clear about the objectives and expected outcomes. Job descriptions should be available for all those involved in the implementation. The goals, values and practices of the change should be discussed in the in-service training programs. Teachers and other implementors should be involved in planning and decision making.

Another recommendation to policy makers and educators is to invest time and resources in in-service computer training for all teachers and principals at all levels of instruction. Inservice education programs should provide opportunities for participants to explore computers, to interact with their peers and to share their ideas and findings with each other through working practically with computers. In-service training courses should focus on practical hands on computer work, not only theoretical material. Universities and teacher training centers should be more active in teaching computer literacy to their students. The findings of this study indicate that most participants, except for the computer teachers, had not taken any computer literacy courses. The content of the in-service computer courses should be determined according to the participants’ needs.

In summary, based on the present study, a number of more specific recommendations can be made to policy makers, teacher educators, and others who are involved in the implementation of computers in Iran. These include:

- Computer teachers and other implementors should be consulted in any further decision making and planning processes.
- Participant’s values and expectations should be considered in the introduction of any innovation.
- More inservice programs should be available to teachers and lab managers. Lab managers should have a job description and enough expertise for doing their jobs. In addition, all computer labs should have lab managers.
- Access to computers for teachers should be available whenever they need it.
- Development of CAI programs based on the Iranian syllabus and the Persian language should be organized and sponsored by the Ministry of Education and be available for all teachers.
- Instead of BASIC programming, use of application programs should be introduced.
- A few hours per week, the computer lab should be free for students use and in particular,
for those who are involved in the Computer Studies course.

- Monitoring and problem solving should be continued throughout the implementation years by the Ministry of Education.
- Rewards and assistance should be provided to motivate teachers. The researcher believes that incentives are crucial for teachers, particularly for computer-related courses, which may compensate for unusually high demands on teacher time and initiative.
- More on-going support should be available for computer teachers, e.g. books and journals about computers, participation in seminars and meetings with other computer teachers. Access to Internet is essential. Communication with other people in the computer field and consultation with computer experts should also be available.
- Each district should have one resource person for computer troubleshooting.
- More cooperation between the Ministry of Education and Ministry of Culture and Higher Education is essential. The broadcasting system could also help in the implementation process by producing more computer literacy programs to increase the public’s knowledge about computers.

6.4 Suggestions for Further Research

Most studies on introduction of computers in education in developing countries have focused only on primary factors in computer implementation such as access to computers and teacher training programs; more research is needed to examine other important factors in the success of implementation, e.g. the role of socio-politico-cultural factors in the implementation of the innovation.

The impact of social context on the success of implementation needs to be further investigated. Gender issues in using computers should be studied in a new way. Most research on gender issues is focused on simple documentation of attitudinal and behavioral differences between men and women (Whitley, 1997). Future research should probably focus more on a more complex set of issues: What cultural values exist concerning girls’ education? What are the cultural values concerning women’s work in the technical jobs? What female role models are present in the education system for girls in the computer field? What is the role of the mass media in providing female role models to girls? Can equitable access for women to “better” types of computer education (i.e.: not role-stereotyped courses in word-processing) help to shift role perceptions and their participation in male-dominated learning areas of mathematics and sciences?

In most Iranian classrooms, teachers were the central focus, as dispensers of knowledge to passive students. In the hands-on classes of the Computer Studies course, some teachers
transformed their teaching style from lecturing to facilitating. However, this study, and others conducted in industrialized countries (Means, 1994; Ragsdale, 1991, 1988), suggested that this transition was not an easy one. More research about this transformation is needed, especially in developing countries.

Computer education in Iranian schools can be expected to grow quickly in the near future. In order to maintain up-to-date information on how schools use computers, longitudinal research needs to be conducted. Also, as the government promotes the initial policies for computer education in Iranian schools, policy analysis research needs to focus on cost and efficacy (Jo, 1996).

This study focused on students of the Computer Studies course and did not attend to students of other academic or professional subjects. More research is needed to focus on students of different backgrounds and levels of education, in diverse disciplines and different types of computer uses.

Similar studies could be conducted to investigate how universities and teachers' training centers in developing countries use computers in their instruction.
REFERENCES


APPENDICES

APPENDIX A: SUPPLEMENT TO FINDINGS

APPENDIX A.1: ADDITIONAL FINDINGS ABOUT POLICY MAKERS

1.1 Administrative Use of Computers

Regarding the administrative use of computers, some policy makers thought that in some places computers were purchased without considering the need. They believed that the computers were placed in the managers' offices only for prestige, even though there was no real need for them. Some of the policy makers thought that in the Ministry of Education, good use was being made of computers for administrative tasks. The reason was that the large volume of manual work, in particular in the transfer of teachers (from one district to other or from one province to the other) had been a very big job and was better done by computers. About the administrative use of computers one of the policy makers stated:

We use it for making decisions about the transfer of teachers. When the transfer is done by computer, there is no place for objection. We also used computers for getting averages, report cards, registration and giving the report cards.

In the new system, principals of high schools would have to use computers for administrative tasks such as registration, providing report cards, etc. By computerizing the administrative tasks, the Ministry of Education would have access to information about other Iranian provinces, too. About the advantages of using computers in administrative tasks, one of the policy makers stated:

With the information about other provinces, we could compare provinces with each other in different areas and discover problem areas. For example, we could see which province is weak in Physics, and look for the reason. If we wanted to do it manually, it would take too much time. By using computers, we could have access to information about students and teachers in different areas. To have extensive information about students and teachers would help us in identifying the problems. So, computer use in administrative affairs has a lot of advantages.

1.2 Future of Computer Use in Iran

Some of the policy makers thought that the public's interest in acquiring computers was related to the newness of this technology. For example, Mr. D. stated:

I think that this sickness of having to have computers will be remedied in the
future when every body bought computers and have it at home and see that they
could not do much with computers and if they do not have it, really they do not
have any problems. But, at this time it is a luxury tool and it is only to get
prestige. And in my opinion, if your problems can be solved without using a
computer (as most cases), it is MD (Management Decoration). And it is a kind of
fashion, such as the fashion of the type of hair, one day the short hair is
fashionable and another day long hair. One day shoes with high heels and another
day shoes with short heels, etc. becomes vogue. When people saturated fully,
using computers won't be continued. I think that this wave is temporary and it
will soon decline.

There were two kinds of attitudes among policy makers toward computers: One group,
including Mr. D., believed that it is a new wave or new fashion such as other fashions in society
and when people are saturated, it would be diminished. The other group are people who believed
that this wave arose because of a real need and it will be continued.

In general, the policy makers' attitudes toward computers depended on the policy
makers' background. If they had computer background, they were more optimistic about using
computers and teaching about them. What was common among these two groups was that they
all believed that there was a need for computer literacy, because both groups believed that if the
people know the capabilities and limitation of computers they would be more realistic and only
people who really need it will buy computers. Therefore, the duty of the Ministry of Education
is to familiarize students with computers. One of the policy makers said that all students should
have computer literacy. Mr. B. stated:

We are planning to add some computer related lessons in Science and Math
subjects. At that time they will not consider the computer as a luxury tool but it
could be considered as a means for getting information. In this case, they could
use the computer properly. We are going to introduce this background knowledge
on computers to all students. They are going to know the capabilities of the
computer, and I think that it should be considered as a new type of literacy for all
people.

Mrs. C. stated:

I think that the future of computers depends on the awareness and computer
knowledge of the public.
APPENDIX A.2: ADDITIONAL FINDINGS ABOUT PRINCIPALS

2.1 Introduction: Results of the Principals' Questionnaires

The data from principals were collected from a sample of thirty high schools from four different districts in Isfahan. The procedure for selecting the principals for the present study was described in Chapter Three. The selected principals were each given a questionnaire to complete. Of the thirty questionnaires which were handed to the sample of high school Principals in Isfahan, thirty were filled out and returned (a return rate of 100%). Sixteen of the principals from different kinds of high schools (public, private, exemplar public schools) were then interviewed. All public computer labs and a sample of two private computer labs and one exemplar public computer lab were also observed. Following are some of results from the questionnaires (principles’ questionnaires are included in the Appendix B.1)

Thirteen of the thirty principals (43%) were female and worked in the girls' high schools and the remaining seventeen principals (57%) were male and worked in the boys' high schools. Twenty seven of the thirty high schools (90%) were public and three were private (10%). The average number of students in each high school was 514. Both the biggest and smallest number of students were from the girls' high schools. One girl's public high school with 1050 students had the largest number of students and one girl's private school with 44 students had the least number of students. The average number of teachers, in this sample of 30 high schools, was 51 teachers per high school. It should be noted that each teacher in the high schools was expected to work 24 hours per week. Usually, teachers in Iran work in more than one high school.

2.2 Principals' Demographics Information

Of the thirty respondents, 43% were female and 57% were male. 77% of the respondents' ages were in the range of 30-40 years, and 23% were in the range of 40-50 years; there were no principals in the age ranges of (20-30) and (50-60).

Principals' experience: 40% of the principals had 1-3 years experience as principals, 13% had 3-6 years experience, 27% had 6-10 years experience and 20% had 10-15 years. As the data indicate, 53% of the principals had less than six years experience and 80% of the principals had less than 10 years. 20% of the principals had 1-3 years vice principal experience, 27% of them had 3-6 years vice principal experience and 53% of the principals did not have any vice principal experience. 33% of the principals had 6-10 years teaching experience, 20% had 10-15 years teaching experience; only 7% had 1-3 or 3-6 years teaching experience. 33% of the principals
did not have any teaching experience.

As the data indicated, principals had different kinds of experience. A majority of them had less management experience than other experience. The reason may be because of the revolution, after which most of the persons who had management positions were retired or returned to other jobs such as teaching or bookkeeping. Therefore, most of the recent managers were new and they had been chosen after the revolution.

Academic Background: 93% of the principals reported that they had only a bachelor degree and 7% of them had a master degree. The principals were from different areas of specialization; 33% had their degrees in science (physics, chemistry and biology), 26% of them had their degrees in arts and literature, 7% had math degrees, 7% had degrees in engineering and only 7% of them had degrees in management. 20% of the principals did not respond to this question.

2.3 Availability of Computer Related Resources:

In the response to the question "Do you have a computer lab in your high school?", ten of the principals (33%) reported that they had computer labs in their high schools. Three of these high schools were private. Seven of them were public, one of these public schools was an exemplar public high school. 100% or all of the private high schools and exemplar public high schools had computer labs. Note that the following questions were to be answered only by those principals who had computers in their schools.

In the response to this question "How many computers do you have in your computer labs?", four of the principals reported that they had 10-11 computers in their computer labs, two had 6-7 computers in their computer labs, three, from private high schools had 4-5 computers in their high schools and one principal, from the exemplar public high school, reported that she had three computers in her school computer lab.

In the response to the question "What subjects have the teachers used computers in your high schools?", all principals who had a computer lab in their high school reported that the computers were used for teaching the Computer Studies course. Two principals reported that computers were also used for CAI purposes. One principal chose Geography and Math and another chose Math. The teachers who used computers for CAI purposes were from public high schools.

2.4 Administrative Uses of Computers

In the response to the question "Do you have computers in your office for administrative
purposes?”, only ten of the principals (33%) reported that they had computers in their high schools for administrative purposes. Eight of these ten principals were from public high schools. Two of these principals were from private high schools.

It is worth mentioning that three of these principals who had a computer for administrative use in their office did not have a computer lab for the Computer Studies course. One of these three was from private high school and two of them were from public high schools.

In the response to the question “How many computers do you have for administrative purposes?”, only one principal from the public high school reported that he had two computers for administrative uses. Nine principals reported that they had one computer for administrative use. All principals who used a computer for administrative tasks reported that they used it for record keeping of students, registration and providing the report card. None of these principals used it for other purposes such as accounting, immunization, programming...

In the response to the question “Who paid for purchasing the computers for administrative purposes?”, five of the ten principals who had computers for their administrative purposes reported that the Board of Education and the Districts of Education purchased the computers. Three reported that the computers were purchased by both districts and high schools’ budgets. Therefore, in total seven of the principals reported that they had the districts’ support for purchasing the computers. Two of the principals reported that the computers were purchased from the budget of the high schools. These principals were from private high schools.

In the interview with the principals, one of them said that besides parents’ financial support, one of her students’ parent had written a program for their school administrative purposes.

2.5 Principals’ Suggestions:

If it were the principals’ responsibility, they would further develop computer labs, and arrange computer classes for all intellectual students who like computers, not limit the use and education about computers to one specific group of students.
APPENDIX A.3: ADDITIONAL FINDINGS ABOUT COMPUTER TEACHERS

3.1 Introduction

In an attempt to gain an overall view of the sample population of computer teachers, personal data were collected through questionnaires. These included gender, age, years of experience in teaching and the subjects which they had been teaching. Information about the teachers' experience related to computers and the implementation issues related to the use of the computer was also solicited. Of the seventeen questionnaires that were handed out to the teachers of the Computer Studies course in four Isfahan districts of education, fifteen were filled out and returned (a return rate of 88%).

3.2 Personal Information

Of the fifteen teachers, the ages of six were in the range of 30-40 years, four were in the range of 20-30 years, four teachers were in the range of 40-50, and only one teacher did not report her age. Five of the fifteen respondents (33%) teachers were female and ten of the fifteen (67%) were male.

All female teachers were teaching in the girls' high schools. Two of the ten male teachers were teaching in both boys' and girls' high schools. Fourteen of the fifteen teachers were teaching in the public high schools. Some of them were teaching in the private high schools, too. The remaining teacher was teaching only in the private high schools.

3.2.1 Academic Background

It is important to note that for teaching in Iranian high schools, teachers should hold a bachelor degree. Twelve of the fifteen teachers (80%) reported that they had a bachelor degree. Three of the fifteen teachers (20%) reported that they have a master degree. In response to this question "what was your major field(s) in university?" The majority of teachers, nine of the fifteen (60%), reported that they had degrees in math. Three of the fifteen (20%) teachers had computer science degrees. Three of the fifteen (20%) teachers had their degrees in other fields such as statistics, science, and communication. The teachers' Demographic information is included in Table A3.1.

Topics taught in the past: All teachers had been teaching the computer studies course and thirteen had been teaching math. None of the participants had ever taught any other subjects.

Topics taught in the present: Eleven of the fifteen teachers reported that they were teaching math and the Computer Studies courses. Four of the fifteen teachers reported that they were teaching only the Computer Studies course.
Table A.3.1: Demographic Information about Teachers

<table>
<thead>
<tr>
<th>ID</th>
<th>Gender</th>
<th>Age</th>
<th>School</th>
<th>Type Of School</th>
<th>Teaching Experience</th>
<th>Subject Previous</th>
<th>Subject Now</th>
<th>Major</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>30-40</td>
<td>girl</td>
<td>public-exemplar</td>
<td>10-15</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Computer</td>
<td>Bachelor</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
<td>30-40</td>
<td>girl</td>
<td>public</td>
<td>6-10</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Statistic</td>
<td>Bachelor</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>40-50</td>
<td>boy</td>
<td>Public</td>
<td>&gt;15</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Math</td>
<td>Bachelor</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>40-50</td>
<td>boy</td>
<td>public</td>
<td>&gt;15</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Math</td>
<td>Bachelor</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>30-40</td>
<td>boy-girl</td>
<td>public</td>
<td>&gt;15</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Math</td>
<td>Bachelor</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>30-40</td>
<td>girl</td>
<td>public</td>
<td>10-15</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Math</td>
<td>Bachelor</td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>20-30</td>
<td>boy</td>
<td>public</td>
<td>6-10</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Math</td>
<td>Bachelor</td>
</tr>
<tr>
<td>9</td>
<td>M</td>
<td>20-30</td>
<td>boy</td>
<td>private</td>
<td>1-3</td>
<td>Computer</td>
<td>Computer</td>
<td>Computer</td>
<td>Bachelor</td>
</tr>
<tr>
<td>11</td>
<td>M</td>
<td>20-30</td>
<td>boy</td>
<td>public private</td>
<td>3-6</td>
<td>Computer</td>
<td>Computer</td>
<td>Computer</td>
<td>Master</td>
</tr>
<tr>
<td>12</td>
<td>F</td>
<td></td>
<td>girl</td>
<td>public</td>
<td>10-15</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Math</td>
<td>Bachelor</td>
</tr>
<tr>
<td>13</td>
<td>M</td>
<td>20-30</td>
<td>boy</td>
<td>public</td>
<td>3-6</td>
<td>Math Computer</td>
<td>Computer</td>
<td>science</td>
<td>Bachelor</td>
</tr>
<tr>
<td>14</td>
<td>M</td>
<td>40-50</td>
<td>boy-girl</td>
<td>public</td>
<td>&gt;15</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Math</td>
<td>Bachelor</td>
</tr>
<tr>
<td>15</td>
<td>F</td>
<td>30-40</td>
<td>girl</td>
<td>public</td>
<td>&gt;15</td>
<td>Math Computer</td>
<td>Math Computer</td>
<td>Math</td>
<td>Bachelor</td>
</tr>
</tbody>
</table>

3.3 Teacher Development Programs

The responses to this question "If you have taken any course(s) related to computers prior to becoming a teacher, then please specify, for each course, the title, who provided the course, the year and place in which course was taken are indicated in table A3.2.
<table>
<thead>
<tr>
<th>ID</th>
<th>Name of Course</th>
<th>years</th>
<th>place</th>
<th>Name of course</th>
<th>years</th>
<th>place</th>
<th>hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FORTRAN, Assembly, COBOL, PL/1, Internal parts of Computers, System analysis</td>
<td>1975-1980</td>
<td>Jondishapour University</td>
<td>BASIC</td>
<td>1988</td>
<td>Isfahan</td>
<td>1-20</td>
</tr>
<tr>
<td>2</td>
<td>Introduction to computers, FORTRAN, PL/1 G.W. BASIC, PASCAL, COBOL.</td>
<td>1979-1989</td>
<td>Mashhad University</td>
<td>Refreshment</td>
<td>1990</td>
<td>Isfahan</td>
<td>1-20</td>
</tr>
<tr>
<td>3</td>
<td>FORTRAN, COBOL, PL/1,</td>
<td>1978</td>
<td>Manchester University</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>FORTRAN, COBOL</td>
<td>1976-1977</td>
<td>Isfahan University</td>
<td>BASIC</td>
<td>1990</td>
<td>Isfahan</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>BASIC DOs</td>
<td>1990</td>
<td>Isfahan</td>
<td>150</td>
</tr>
<tr>
<td>6</td>
<td>Introduction to computers</td>
<td>1983</td>
<td>University</td>
<td>BASIC refreshment</td>
<td>1992</td>
<td>Isfahan</td>
<td>150</td>
</tr>
<tr>
<td>7</td>
<td>Introduction to computers</td>
<td>1982</td>
<td>Isfahan University</td>
<td>BASIC</td>
<td>1990</td>
<td>Isfahan</td>
<td>200</td>
</tr>
<tr>
<td>8</td>
<td>Introduction to computers</td>
<td>1986</td>
<td>Isfahan University</td>
<td>BASIC</td>
<td>1991</td>
<td>Isfahan Private</td>
<td>1-20</td>
</tr>
<tr>
<td>9</td>
<td>Computer Languages and other courses related to Software specialization</td>
<td>1991-1995</td>
<td>Isfahan University</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Introduction to computers</td>
<td>1988</td>
<td>Isfahan University</td>
<td>BASIC, DOS</td>
<td>1990</td>
<td>Isfahan Private</td>
<td>130</td>
</tr>
<tr>
<td>11</td>
<td>Programming</td>
<td>1989</td>
<td>Industrial University</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>FORTRAN</td>
<td>1977</td>
<td>Isfahan University</td>
<td>BASIC</td>
<td>1990</td>
<td>Isfahan</td>
<td>150</td>
</tr>
<tr>
<td>13</td>
<td>Programming languages: C, PASCAL,...</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>Introduction to computers</td>
<td>1983</td>
<td>Isfahan University</td>
<td>BASIC Refreshment</td>
<td>1991</td>
<td>Tehran</td>
<td>150</td>
</tr>
<tr>
<td>15</td>
<td>Introduction to computers</td>
<td>1984</td>
<td>Isfahan University</td>
<td>BASIC QBASIC</td>
<td>1991</td>
<td>Tehran</td>
<td>150</td>
</tr>
</tbody>
</table>

Table A.3.2: Teacher Development Programs
In the follow up interviews, teachers were satisfied with the ratio of theory to practice in the In-service training courses compared to the pre-service courses which they had in the universities. In the interview with one of the in-service training teachers, he said:

Teaching teachers requires more experience. Teachers who have many years of experience in teaching need more practical projects than theoretical. So, I thought that doing projects is a good idea for teacher training. Therefore, in-service training courses were accompanied by doing projects and they were more practical compared to the universities whose training courses are more theoretical.

According to one of the in-service training teachers, compared to students, teachers are usually impatient about their progress on the computer. At the beginning of the in-service training courses, some of the teachers thought that they would never be able to learn anything about computers. Some of them wished they were younger so they could learn faster. One of the computer teachers reported that in addition to participating in the in-service training courses related to the computer, he had spent more than one thousand hours of his own time learning different aspects of computers.

In the response to the question “Who provided the in-service training course(s)?”, nine of eleven teachers who had participated in the in-service courses reported that the Board of Education provided in-service courses for them. Three of these nine teachers also reported that the university or college had provided computer in-service courses for them. In the follow-up interviews, these three teachers reported that the Board of Education had used university facilities (computers and experts) for teaching in-service courses about computers. Two of the eleven teachers who had computer in-service courses, reported that they had also participated in the private classes. Nine of eleven teachers who participated in the in-service programs reported that the Board of Education had paid for their in-service training. Two of eleven teachers who had computer in-service training courses reported that they paid for their in-service training expenses themselves. As the data indicate the Board of Education provided and paid for computer in-service training for the large majority of teachers (80%). These data show that this program is supported mostly by the government.

In the response to the question “What topics were covered in the in-service course(s)?”, the data about the subjects which were taken by teachers who participated in in-service training, one of teachers did not respond to this question. Nine of ten who took computer in-service training courses reported that they had taken Introduction to Computers. All of them had taken at least one programming course during their computer in-service training. Only two of ten had learned about word-processing. Six of ten reported that operating system principles were
covered in the computer in-service training. There were no reports about teaching other computer applications such as spreadsheets, databases, communication during the teachers' computer in-service training courses. One of the female teachers said "I know that there exist application programs but I personally never used these packages".

3.4 Availability of Computer Related Resources

3.4.1 Students’ Access to Computer Lab

In the response to the question "Approximately how many students are there in every Computer Studies course class?", seven of fifteen (47%) teachers reported that there were 30-35 students in the Computer Studies class. Four of fifteen (27%) teachers reported that there were 40-45 students in the Computer Studies class. Four of fifteen (27%) teachers reported that there were 50 students in each of the Computer Studies class. According to the interviews with the computer teachers, the classroom structure in the hands-on time has been changed. About this new situation one of the computer teachers said:

In the computer lab classes, the students of the class are divided into two groups. In each hands on session in the computer lab, half of the class members will work with computers.

In the response to the question "How many students work at any one computer station?", seven of fifteen teachers (47%) reported that two students were working with each computer. All private school teachers reported that two students were working with each computer. Four of fifteen teachers (27%) reported that two or three students were working with each computer. Two of fifteen (13%) teachers reported that four or more students worked with each computer. One of fifteen (7%) reported that three or four students worked with each computer. One teacher reported that three students work with each computer. As the data indicates, the situation is different in different schools. Based on the researcher’s observations, two-four students were working at each computer station in the lab. In the interview with these Iranian teachers, however, almost all of them felt that they would prefer two students working with each computer. They thought that if more than two students work with each computers, some of the students could not even touch the keyboard, because every time the students who are more knowledgeable would work with the keyboard. So, some of students would be disadvantaged in this process.

Teachers tended to put the students into groups either randomly, based on their academic ability, or according to their familiarity with computers. Some teachers allowed their students to choose their own computer partners, so that they were free to change their partners every time.
they wished. In an interview with one girls’ teacher, she commented that the best arrangement of students in the group is based on their ability. If students with similar ability worked together, they would help each other better and have equal time on computers.

3.5 Teachers’ Problems in Teaching the Computer Studies Course

The results of the question “In teaching the Computer Studies course, what kind of problems did you experience?” are shown in Table A.3.3.

Table A.3.3: Teachers’ problems in teaching Computer Studies course Broken by gender

<table>
<thead>
<tr>
<th>Problems</th>
<th>Male n= 10</th>
<th>Female n= 5</th>
<th>Total N=15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical problems</td>
<td>8</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>Insufficient hardware</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Insufficient software</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Insufficient Hands on time</td>
<td>8</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Insufficient time for theory</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Lack of student motivation</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Variation in students’ knowledge</td>
<td>9</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Students found concepts too difficult</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Discipline Problems</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: Respondents chose more than one option.

As can be seen, twelve of fifteen teachers (80%) perceived large variations in the students’ computer knowledge as a serious problem in teaching the Computer Studies course. 90% of the male teachers and 60% of the female teachers pointed to the existence of a difference in students’ knowledge about computers.

Twelve of fifteen teachers (80%) reported that hands on time on computers was not enough. In the follow up interviews, teachers stated that students need more hands on time on computers to practice what they have learned theoretically. Two hours of hands on practice scheduled every two weeks is not enough for them. By the time they get used to the keyboard, the time is finished. They also said that the students enjoyed the practical section of the course more than the theoretical part. Having technical problems in the Computer Studies course was another problem mentioned by teachers in the questionnaires. Ten of fifteen teachers (67%) reported having technical problems. Of these, all female (five of five) and five of ten male teachers (50%) had technical problems in working with computers. Seven of fifteen teachers (47%) pointed to the lack of student motivation as a problem in the implementation of the
computers. Of these, five were male teachers (50%) and two were female (40%). Nine of fifteen (60%) teachers said that the Computer Studies course is more theoretical than practical. All female teachers selected this choice when only four male teachers did. Six of fifteen teachers (40%) reported that students found concepts/skills to be too difficult. Of these, four were female (80%) and only two (20%) were male.

3.6 Teachers’ Suggestion

One of the computer teachers suggested some ways to encourage teachers for teaching and learning about computers. His suggestions were as follows:

• More facilities in the computer lab should be available and the hours of hands on practice be increased. According to the computer teachers, during three hours of teaching The Computer Studies course, students should have access to computers to be able to try problems with computers until they could understand their mistakes better.

• In-service teachers training courses are not enough. There should be more in-service programs for teachers. Consistent training courses would be necessary.

• There should be more trained teachers for teaching this course to let unwilling teachers go.

• Books and other educational materials such as different journals and bulletins written in English or Persian should be available to teachers.

• Questions from the Computer Studies course should be included in the university entrance exam until students consider it more seriously.

• Different educational software should be available and math teachers should be trained to use at least one of the math software.

• Teachers should have meetings to discuss their issues.

• Teachers should have computers with color monitors.

• There should be some promotional motivation for the Computer Studies course teachers such as financial promotions or other kinds of promotion.
APPENDIX A.4: ADDITIONAL FINDINGS ABOUT LAB MANAGERS

4.1 Introduction

Four of the boys' public computer labs had a computer lab manager. None of the girls' computer labs and private computer labs had a computer lab manager. The four computer lab managers had different academic backgrounds. None of them had computer science or management experience. One of them had a bachelor in science, the other three had teacher certificates in different areas of specialization such as English, Persian literature, and technical certificates.

4.1 Computer Managers’ Responsibilities

The four lab managers reported that they did not have formal job descriptions and were unsure of their job duties. However, all were responsible for scheduling and maintaining lab facilities, and supervising classes when the teacher was not available. Scheduling was accomplished in consultation with teachers at the beginning of each academic year. Some flexibility was built in - two afternoons a week were not scheduled for the Computer Studies course and the computers could be used for other purposes.

At the beginning of the academic year, lab managers formatted students’ diskettes and checked them for viruses. These diskettes were handed out to students at the beginning of each practice class and returned at the end. Every three months the diskettes were examined to provide report cards, and at the end of the year used to provide the final mark. Lab managers confiscated students’ personal diskettes and did not return them until the end of the year.

Each lab manager was free to formulate whatever rules of conduct in the lab he wished. Most prohibited use of personal diskettes; food or drink; magnets, metal and transistors; smoking; moving computers; turning computers on and off too frequently.

4.2 Computer Lab Managers’ Backgrounds

Three of the four computer lab managers had been inspectors for the KAD instruction, supervising students in the KAD apprenticeship workshops. After the computer labs were established, the three were chosen as computer lab managers. None had any pre-service courses, two had taken 20-hour in-service training courses which included some DOS commands and
brief familiarity with BASIC, and the third had paid for computer related courses from private organizations.

The fourth lab manager had previously taught English. He had no pre-service training, but had participated in the 72 hours of in-service training arranged for the officers of the Board of Education. In this training he had learned about DOS, Algorithms, Flowcharts and BASIC. However, he said he had learned more from the computer teachers and through working in his lab than from the in-service training. Following are some of the problems reported by the lab managers:

4.3 Shortage of Students’ Access to the Computers

All computer managers believed that the practical work on computers was not enough. One week was for the theoretical part and one week was for the practical part. According to the lab managers, the booked classes came to the lab and used it according to the scheduled timetable. They could not arrange for more time than scheduled because of the other classes.

One of the managers said that some of students were very good in programming but they were very slow at working with computers. Even though some of them got very high marks in the competition they were very weak in working with computers, because they did not have enough access to the computers.

According to the lab managers, some of the computer labs arranged for remedial programs for students who were weak in the Computer Studies course and got money from them. These classes were supervised by the Board of Education. Regarding the use of computers by teachers of other subjects, one of the lab managers said that sometimes other teachers wanted to use the computer lab for computer assisted learning.

The problem is that we do not have free time during the hours the teachers need it. During Tuesday and Thursday afternoons when we do not have the Computer Studies courses, other teachers could use the lab if they want.

According to one of the lab managers, computers sometimes were used for doing administrative tasks by the principal or bookkeeper in the high schools which did not have access to computers for doing their administrative tasks.

4.4 Lack of Support

The computer labs did not have an independent budget. According to the lab managers, no supervision was provided by the principals because the principals did not have enough
information and knowledge about computers. They felt that the lab supervision - whether by the principals, districts' administrators, or Board of Education - was not determined. According to the lab managers, all of them were very demanding, but when a problem was encountered the computer managers did not know to whom it should be referred. There were no written rules. All lab managers were worried about security problems.

The lab managers complained that they did not have a job description and a specific organizational post, and that because of the newness of the position, they did not have special tasks.

One of the lab managers complained that all the computers in his lab were slow 286s without hard drives or printers and computers were not equipped with anti-virus software. The computers were guaranteed for the first two years only. Two of the lab managers wanted a special place for keeping different diskettes and different software. According to the lab managers, labs were not standard and a lot of dust existed in the computer labs.

4.5 Suggestions by the Lab Managers:

All of the lab managers said that if they had the responsibility, they would increase the lab facilities and arrange for more inservice computer training courses for the lab managers. Following are some of lab managers' suggestions:

• The lab supervision—whether by the principals, districts' administrators, or Board of Education—should be determined.
• Lab managers should have a job description to determine their duties.
• Every computer lab should have its own budget. Therefore, if a lab is going to make money, the income should be spent in the computer lab.
• The maintenance of the computers should be considered more seriously by the administrators. The computer lab managers suggested that the labs should be equipped in terms of security. All labs should be equipped with security locks and alarms. The lab managers thought the computer lab should have a telephone, but the principals disagreed with that.
• Some educational programs such as math or statistical packages should be available in the computer lab. Word-processing in Persian should be available on all the computers. Every lab needs to have a library that keeps the references and educational books related to computers. They also suggested establishing a center for keeping and distributing different software and applications packages in the Board of Education from which one could borrow.

One of the lab managers suggested that the computer lab should be located in another place separately from the high school with a separate door. He said that if the lab was separated from the high school, girls could be accepted during the time that they did not have computer
labs. They suggested that there should be special meetings with the intermediate education administrators from the districts and the computer managers in the labs to talk about their experience, the way of administrating the labs, how the computers could be used and serviced. Any useful experience should be shared and the best way to manage the computer labs should be determined. They also suggested that computer labs should be used during the summer and other holidays for teaching about computers to other students, such as elementary or guidance school students or even different branches. Some other suggestions by the lab managers were as follows:

- All computers should be the same model.
- Each student should work alone with one computer.
- One technical supervisor should visit the computer lab every 15 days or each month to see if there were any problems in the lab
- The training courses should be increased. One of the computer lab managers said “with more training courses, we will have more knowledge about computers, and hence problems would decrease”.
APPENDIX A.5: ADDITIONAL FINDINGS ABOUT TEACHERS OF OTHER SUBJECTS

5.1 Introduction

One school from each gender was selected randomly for the purpose of obtaining information about the use of computers in other subject areas. Eight teachers from subject areas other than the Computer Studies course were selected in each school for focused interviews according to their interest and the subject which they were teaching. All teachers in the focused interviews had a bachelor degree; one was studying for a master's degree.

A large majority of teachers were positive toward using computers in instruction. They thought that the syllabus was very boring, demanding that students memorize everything, and learning with a computer would reduce the frustration and boredom of the lessons and make learning more interesting for students. In spite of their high interest in using computers in instruction, they did not use computers for the following reasons: lack of hardware (90%), lack of training (85%), lack of time (73%), lack of software (63%), language problems (56%), and complexity of the computer technology. These problems will be discussed in the following section.

5.2 Teachers' Problems in Using Computers

5.2.1 Computer Access:

The teachers did not have access to computers. A majority said that they could not use the computer lab because it was scheduled from the beginning of the year for the Computer Studies course. Some teachers thought that they would never have access to computers and could not use them for instructional purposes. A large majority of teachers did not have access to home computers. Only one of the sixteen teachers had a computer at his home.

5.2.2 Lack of Computer Knowledge:

Most teachers did not know how to work with computers. In general, the majority of teachers were curious and eager to learn about computers. They had different reasons for their enthusiasm towards computers. Some of them said, although they did not have computers at their schools, they thought that in the near future all schools would be equipped with new technology and everybody would need to know about it. Most teachers compared learning about
computers with literacy and they said that knowledge about computers is the new literacy. They pointed to the UNESCO slogan that in the near future the people who do not know about computers would be considered illiterate. Most of these teachers felt that they were not prepared for this new technology.

Some teachers reasoned that because their students already knew about computers, they would ask some questions that the teachers would not be able to answer. In this situation, teachers would be embarrassed in front of the other students. The teachers believed that from the prestige point of view, this is not acceptable for them. One of the women teachers argued that if they learned about computers, they would be able to transfer the knowledge to their children. Some of teachers said that even if they had a computer, they would not use it because they were not prepared.

**Teacher Training Courses:** Thirteen of the sixteen teachers did not have any computer related courses during their pre-service programs in the university or teacher training center. The three teachers who had computer pre-service courses were from the math and science majors. A few teachers had participated in the computer courses in the private organizations. For instance, the teacher of religion said that she participated in the private classes and she learned some DOS commands, BASIC, flowcharts and algorithms. She said that she did not use her knowledge at school because they did not have a computer at school but she used the software packages for writing her thesis. She was also familiar with the software about religion which existed in her field.

Only one teacher had participated in an inservice computer course (a 20-hour BASIC course) arranged by the Board of Education as an extracurricular activity. She had paid a small amount of money. A large majority of teachers objected that there were not enough computer inservice training courses for teachers other than computer teachers. They also argued that what the teacher trainers taught in the inservice training was only about BASIC, which was not very useful for all teachers; instead, if they taught teachers how they could use computers and about operating systems or use of some educational programs or application programs, it would be most useful.

There were also a few teachers who were not interested in learning about computers. For example, two teachers said that they did not like to learn something that they did not have any plan to use. One teacher said, “this will not happen during my teaching time to use computers, I have been teaching for about 23 years, and by the time that schools will be using computers for
APPENDIX A.6: ADDITIONAL FINDINGS ABOUT STUDENTS

6.1 Introduction

125 students from each gender were selected randomly from the list of students of each gender from the 30 selected high schools to complete the questionnaires. According to the students’ response to the questionnaire and their interest in participating in the interview, 35 students were subsequently interviewed.

6.2 Demographics Information about the Students

250 questionnaires were administered to the high school students in grade 11 Math and Physics. The questionnaires were distributed equally between the two genders. In total, 224 questionnaires were completed and returned by the students. The total response rate was 90%. 54% of the returned questionnaires (122) were boys’ compared to 46% (102) from girls. The return rate for boys was 99% but for girls only 82%.

The range of students’ age was 16-20 years. 65% of students were seventeen years old, 17% of students were sixteen years old, 15% of students were 18 years old. Less than 10% were aged 19 and 20, all boys.

6.3 Students’ Computer Knowledge

The students’ responses to the question “Which of the following computer related areas are you familiar with?”, is presented in Table A.6.1.

The most important knowledge domains were programming, games, operating systems, and graphics. As can be seen from table A.6.1, not surprisingly, all students knew about programming. 49% of all students who answered the questions reported that they knew about games (63% of the boys, 32% of the girls). 33% of students were familiar with operating systems and appropriate DOS prompts. The other computer fields which students were familiar with were graphics (25%), and computer music (11%). Less than 10% of the students were familiar with other computer applications such as CAI (8%), word-processing (8%), databases (5%), communications (3%), and hardware (3%), and spreadsheets (less than 1%).
Table A.6.1: Areas of Students’ Knowledge about Computers

<table>
<thead>
<tr>
<th>Area of Students’ Computer Knowledge</th>
<th>Boys n=114</th>
<th>Girls 100</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Assisted Instruction</td>
<td>16</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>13%</td>
<td>2%</td>
<td>8%</td>
</tr>
<tr>
<td>Programming</td>
<td>114</td>
<td>100</td>
<td>214</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Graphics</td>
<td>42</td>
<td>12</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>36%</td>
<td>12%</td>
<td>25%</td>
</tr>
<tr>
<td>Computer Music</td>
<td>13</td>
<td>10</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>11%</td>
<td>10%</td>
<td>11%</td>
</tr>
<tr>
<td>Communications</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Word-processing</td>
<td>9</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>8%</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Spreadsheet</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Databases</td>
<td>11</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>Hardware</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Operating systems</td>
<td>57</td>
<td>14</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>14%</td>
<td>33%</td>
</tr>
<tr>
<td>Games</td>
<td>72</td>
<td>32</td>
<td>104</td>
</tr>
<tr>
<td></td>
<td>63%</td>
<td>32%</td>
<td>49%</td>
</tr>
</tbody>
</table>

Note: Respondents could choose more than one option

For the boys the most important fields of their computer knowledge were programming (100%), games (63%), operating systems (50%), graphics (36%) and computer music (11%), while the most important fields for the girls were programming (100%), games (32%), operating systems (14%), graphics (12%), and music (10%). As the data indicate, in all areas of computer related knowledge, the number of boys was greater than the number of girls.
Table A.6.2. Problems Experienced in the Computer Studies course

<table>
<thead>
<tr>
<th>Problems</th>
<th>Boys n=118</th>
<th>Girls n=102</th>
<th>Total N=220</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical problems</td>
<td>41 35%</td>
<td>21 21%</td>
<td>200 91%</td>
</tr>
<tr>
<td>Insufficient hardware</td>
<td>69 59%</td>
<td>78 77%</td>
<td>136 67%</td>
</tr>
<tr>
<td>Insufficient software</td>
<td>81 69%</td>
<td>29 28%</td>
<td>110 50%</td>
</tr>
<tr>
<td>Insufficient Hands on time</td>
<td>85 72%</td>
<td>100 98%</td>
<td>185 84%</td>
</tr>
<tr>
<td>Insufficient time for theory</td>
<td>23 20%</td>
<td>33 32%</td>
<td>56 26%</td>
</tr>
<tr>
<td>Lack of student motivation</td>
<td>38 32%</td>
<td>31 30%</td>
<td>69 31%</td>
</tr>
<tr>
<td>Variation in students' knowledge</td>
<td>94 77%</td>
<td>30 29%</td>
<td>124 56%</td>
</tr>
<tr>
<td>Students found concepts too difficult</td>
<td>20 17%</td>
<td>36 35%</td>
<td>56</td>
</tr>
<tr>
<td>Discipline Problems</td>
<td>50 42%</td>
<td>0 0%</td>
<td>50 23%</td>
</tr>
</tbody>
</table>

Note: Respondents chose more than one option.

84% of the students (72% of boys, 98% of girls) reported that the lack of hands on time was the most important problem in using computers in the computer lab. 67% of the students (58% of boys, 76% of girls) pointed to insufficient hardware. 56% of the students (77% of boys, 29% of girls) reported that there was variation in the students' computer knowledge. 50% of the students (69% of boys, 28% of girls) reported that insufficient software was one problem in using the computer lab. The other problems reported by the students were: lack of motivation (31%), shortage of theory time (26%), the course skills were too difficult (26%).

Motivation: In the pilot study, when the researcher had focused interviews with students from one of the girls’ schools and one of the boys’ schools, a large majority of students (in particular girls) claimed that they were very interested in computers before taking this course, but during the course they lost a lot of their initial motivation. They suggested some solutions for increasing the students’ motivation. The researcher included the students’ suggestions in an additional question in the students’ questionnaire to solicit other students’ views (for more information see question 4.5 in the student questionnaire in the Appendix B.3). The students’ responses are shown in Table A.6.3.
### Table A.6.3: Frequency of Motivational Factors

<table>
<thead>
<tr>
<th>Motivational Factors</th>
<th>Boys n=119</th>
<th>Girls n=101</th>
<th>Total N=120</th>
</tr>
</thead>
<tbody>
<tr>
<td>The CSC be included in UEE.</td>
<td>25</td>
<td>4</td>
<td>29</td>
</tr>
<tr>
<td>The CSC should be taught before the high schools.</td>
<td>73</td>
<td>52</td>
<td>125</td>
</tr>
<tr>
<td>The CSC should be taught in grade 9,10,11 high school.</td>
<td>40</td>
<td>63</td>
<td>103</td>
</tr>
<tr>
<td>The CSC should be more practical.</td>
<td>68</td>
<td>74</td>
<td>142</td>
</tr>
<tr>
<td>More computer access should be available.</td>
<td>94</td>
<td>78</td>
<td>172</td>
</tr>
</tbody>
</table>

**Note:** Respondents chose more than one option.

For increasing the students' motivation, 78% of the students suggested that they should have more access to computers. About 65% of the students reported that the hands-on time on the computer should be increased. 57% of the students reported that the computer should be taught before the high school level, namely in the Guidance level and during the Elementary level. One reason was that students were involved in preparing for the UEE and they did not want to be involved in other activities that were not related to the UEE. 47% of the students said that the computer should be taught during the grade 9, and 10 as well. Most girls wanted more computer courses during the high school years. Only 13% of the students wanted to include this course in the UEE exam.

#### 4.6.4 Students’ Suggestions Regarding the Computer Studies course

Some of the interviewed students said that if they had the authority to make such decisions, they would suggest teaching about computers in the primary level. They thought that students could become familiar with computers by playing computer games at the elementary level. After being acquainted with computers in this way, they would be more interested in learning more about computers. Some students believed that learning about computers should not begin with programming. At first the students should learn some general principles about
computers and applications, or games and then programming. They suggested that teaching about computers should begin with teaching about DOS. Students have to learn some basic operations such as save, copy, or format. They suggested teaching about computers for two years, one year for working with the computers and the computer functions and another year for programming. According to students, learning about computers should not be limited to programming; the computer has a wide array of applications. Students have to be taught about the other applications.

One student said that he had taken courses about computers for two years but still had a problem in this course. He thought that programming requires strength in Mathematics. The Mathematics in their book was not related to the other math books and the math problems were very difficult. He complained that he had to write the computer programs according to the problems, but the problems were not solved in class. He and other students suggested that the computer book and the problems in this book should relate to the Math books. The majority of students thought that programming is like pure math and boring. They said that they had not used any educational programs nor used the computer as an a tool in learning, but had heard that there were some ESL programs as well as Geography and biology software. Most students thought that one year is not enough for teaching about computers. They should teach about computers in lower levels of school and in high school, students should be taught only programming.

One of the boys said that he liked the graphics very much. He said that he liked to put music on the programs, and change the games, he said that he edited the programs as he liked. He said that at first he used the computers just for playing games and that's how he got interested in computers. Students suggested that the teachers should integrate computers in to the curriculum, in particular for teaching Math. If they used computers in teaching math, the students would understand the math better and they would acquire some computer skills. Although most students were more or less satisfied with the Computer Studies course, there were a few students who were dissatisfied. One of them said:

There is no suitable environment, no attraction, no application, no possibilities, no facilities. I think that I would never use the knowledge that I get from this course. In Iran the computer does not have any place and people buy it for prestige, fashion, and entertainment. I met people who do not know how to turn the computer on and off, but they have bought computers for prestige. I like to learn Graphics would like to work for a TV station and use the Graphical computer images.
APPENDIX A.7: ADDITIONAL FINDINGS ABOUT PARENTS

7.1 Parents interviews

The parents of thirty randomly chosen students were contacted. After the researcher introduced herself and the purpose of the research, some demographic information was gathered and the arrangement for an interview meeting based on their choice of which parent would be interviewed was made. One parent from each family was interviewed. The results of the parents’ interviews are presented in this section.

7.2 Demographic Information about the Parents

First, demographic information of the group consisting of both parents of the chosen students will be presented. Twenty one of the thirty mothers were housewives. Six of the thirty mothers were teachers and three worked in government offices (e.g., department of hygiene). The information about parents’ education is summarized in Table A.7.1.

Table A.7.1: Demographic Information for Total Group of Parents

<table>
<thead>
<tr>
<th>Parent</th>
<th>Illiterate</th>
<th>Primary Education</th>
<th>Secondary Education</th>
<th>University Education</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td>5</td>
<td>10</td>
<td>12</td>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>Father</td>
<td>1</td>
<td>5</td>
<td>10</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>15</td>
<td>22</td>
<td>16</td>
<td>59</td>
</tr>
</tbody>
</table>

One of the twenty nine fathers was a medical doctor, one was an engineer. Six of these twenty nine fathers had bachelor degrees and worked in different government offices such as health and treatment, hydra, army, etc. Four of the twenty nine had college degrees and ten had secondary education. Five fathers had elementary education and only one was illiterate.

7.3 Demographic information about the parents who were interviewed

In the sample of thirty parents who were interviewed, thirteen were mothers and seventeen were fathers. Nine of the thirteen mothers were housewives, three of them were teachers and one was working in an office. Fathers were from various professions, such as teacher, doctor, farmer, bookkeeper, army officer, and had different levels of education. Table A.7.2 presents the parent’s education of the sample.
All mothers (3) with university degree participated in the interview. In general, parents with higher education were interested in being interviewed. In a few cases, mothers who were less educated than fathers participated in interviews.

7.4 Computer Experience Background

None of the mothers in this sample had a computer background. None of the seventeen fathers had taken computer courses during their studies in the university. Only two of the fathers had taken computer inservice training. One of these was working in the bank and the other was working in the translation office. These two had university degrees.

Only one father, who had a technical job, said that he had taken a computer course in a private company because of his curiosity about computers and what he had seen on TV about computers. He said that he was not using his computer knowledge in his job, but he was using his knowledge about computers for personal tasks such as writing letters. Through interviews, most parents reported that their knowledge about computers was limited to what they had seen or heard on TV, the radio, their family and friends, in particular the ones who live abroad.

7.5 Access to the Home Computers

Four of the thirty parents said that they had computers at home. One of these was a doctor. He said that he did not know much about computers himself but he had heard and seen the different uses of it. He said that he bought the computer for his two children, in particular for his son who was studying in high school and had taken the Computer Studies course. He said that he was interested to learn about computers but did not have enough time to spend on the computer.

Another parent who had a computer at his home, worked in the translation office and he used a home computer for doing his work during the weekend and holidays. He used word-processing and some graphics packages. He said that his children had permission to use the computer for programming or learning about application programs such as WP but not for games and entertainment. He said that students needed to learn about application programs in the
schools. He said that he forced his children to learn about computers, in particular WP.

Two of the other parents who had computers at home were working in the private sector. They said that they had bought the computer for their children, because some other children in their family had a computer and their children asked them to buy one for them. They said that they did not know anything about computers but they had seen various uses of computers on T.V.

In the interview with the parents who did not have computers at home, the majority of them (17 of 26) said that if their financial situation allowed for it, they would provide a computer for their children.

One of the students’ mothers said that her son was not satisfied with the Computer Studies course, because of the shortage of the computers. She said that many students were working with each computer. Another mother said “My son did not make any progress at the computer, because he did not have a computer at home.” In response to the researcher’s question about “how do you know that he did not make any progress?” she answered

Because of his score in his exam I think that learning computer programming requires practice and hands on work, but the possibility for practice and hands on work is not available in our home or in our family. In our family only Haji (means her husband) has a high education level (college education), and nobody knows about computers be able to help my son. On the other hand, our home is in Baharestan (a suburb of Isfahan) and it is very far from Isfahan. So, he can not use his classmates’ help, too.

Most parents said that if the students had access to a computer, they would have learned much better, because computer skills are volatile and need a lot of practice. If they did not practice what they had learned, they would have forgot it. Some parents said that if they knew a good place for teaching about computers, they would send their children to learn more about the computers. One of these parents said

I think that the government and the Ministry of Education should put more money into computer education. So, if I could not provide a computer for my children at home, they should have access to computers in the schools.

One of the parents said that unfortunately, in Iran the use of computers in education was relatively new and was not considered serious enough. Many private classes were established to teach about computers. She said that private schools were equipped with all the facilities such as Physics, Chemistry, and Computer labs, but these facilities did not get used and the schools only had them, in order to get more money from the parents.
APPENDIX B

Cover letter to the sampled principals, teachers, parents and students

Bibi Zamani
Amdegah St. # 219
10. April. 1995

Dear Mr/Ms.

I am a Ph.D. student in the university of Toronto. My study is concerned with the use of computers in Iranian high schools and related implementation issues. The results of this study will help to provide important information about how Iranian high schools are using computers in teaching and learning and related implementation issues, to offer valuable suggestions for policy/decision makers and (possibly) teachers/ principals.

The researcher would appreciate it if you complete the attached questionnaire and return it to her as soon as possible. The researcher guarantees that no one will have access to the information that you provide here, except for the researcher. Schools and Board of Education will not be allowed access to individual responses. After data analysis, all questionnaires will be destroyed. Your name and your school’s name will never be mentioned in the final report. At the end of the study, the researcher will be pleased to send you a summary of the study results if you so request.

Please note that you have no obligation to complete the questionnaire nor to participate in a follow up interview or classroom observation, in case you are selected. You are free to withdraw from the study at any stage. Also, note that this study does not involve any evaluation of your work. Thank you very much for your time and cooperation.

Your sincerely

Bibi Eshrat Zamani
APPENDIX B: QUESTIONNAIRES

APPENDIX B.1: Questionnaire for principals

Section 1. Background Information:

1.1- Your name ........................................

1.2- Your gender. ( ) Male ( ) Female

1.3- Your Age. [ ] (20-30) [ ] (30-40) [ ] (40-50) [ ] (50-60)

1.4- Number of years you have been principal [ ] (1-3) [ ] (3-6) [ ] (6-10) [ ] (10-15) [ ] (15 or more)

1.5- Number of years you have been vice principal [ ] (1-3) [ ] (3-6) [ ] (6-10) [ ] (10-15) [ ] (15 or more)

1.6- Number of years you have been teacher [ ] (1-3) [ ] (3-6) [ ] (6-10) [ ] (10-15) [ ] (15 or more)

1.7- Academic background degree: [ ] (Teacher certificate) [ ] (Bachelor) [ ] (Master or higher degree)

1.8- Your major field in university? ....................

School Background

1.9- Name of your school. .........................

1.10.- Kind of school. ( ) [boys] ( ) [girls] ( ) [private] ( ) [public]

1.11- Number of students in your school? ............

1.12- Number of teachers in your school? ..........

Section 2. Computer Access

2.1- Do you have a computer lab in your high school? ( ) Yes ( ) No

If the answer is no, please go to the section 3.

2.2- How many computers do you have in your computer lab?

2.3- In what subjects have the teachers used computers in your high school?

( ) Math and Physics ( ) Science ( ) Chemistry ( ) Social Science ( ) Geography

( ) The Computer Studies course ( ) History ( ) Fine Arts ( ) Literature

( ) English ( ) Others, please specify

2.4- Are the computer facilities equally available for all students in your school? ( ) Yes ( ) No
2.5- Which students could use the computers in your school more than others? (please check all relevant)
( ) Students who are taking the Computer Studies Course.
( ) Students who have already taken the Computer Studies Course.
( ) Students who have difficulty and need more help.
( ) Students who have experience in using computers.

2.6- Could students use computers after school hours or during breaks? ( ) Yes ( ) No

2.7- Could students use the school computers for the personal purposes? ( ) Yes ( ) No
If the answer is no, why?

2.8- Are the teachers free to use the computers as they wish, after school hours? ( ) Yes ( ) No

2.9- Could teachers use school computers for their personal purposes? ( ) Yes ( ) No
If the answer is No, why? ..................................................

2.10- What software do you have at your school? ...........................................................

2.11- In what language is the software? ...........................................................

Section 3. Principals' Training Development Courses
3.1- Have you taken any pre-service computer course during your university studies? ( ) Yes ( ) No

3.2- Have you participated in any in-service courses related to computers? ( ) Yes ( ) No
If the answer is no, please ignore the rest of questions.

3.3- How many hours in total have you taken computer in-service courses? ..................

3.4- Do you think that the computer in-service courses provided by the Board of Education are sufficient for the principals? ( ) Yes ( ) No

3.5- If you have taken any in-service computer training courses, were the courses beneficial for you?
( ) Yes ( ) No

3.6- Is there any special motivation for principals to learn about computers? ( ) Yes ( ) No

Section 4. Principals' Attitudes toward Computers
4.1- Which of the following reasons are the most important for justifying learning about computers in schools?
(You can check more than one answer)
( ) a- Because it helps student(s) to find a job easier
( ) b- Because of the extended uses of computers in society, everyone should have some knowledge about computers?
( ) c- Because, if the students know about computers, they will get higher ranking in the University Entrance Exam.
( ) d- Because, computer use helps students to think more logically and it will help them in their studies
( ) e- Because, by using computers, changes will happen in teaching and learning style.
( ) f- Because, it is a good instrument for entertainment.
( ) g- Because of other reason(s), (please specify)

4.2- In your opinion which students should learn how to use computer(s)?
( ) only boys
( ) only girls
( ) both girls and boys.
( ) none
In your opinion, which of these areas are necessary for boys to know about? (check all those that you think are relevant)

- Word-processing
- Spreadsheets
- Databases
- Communications
- Programming
- Hardware / computer architecture
- Graphics
- Music
- Desktop publishing

In your opinion, which of these areas are necessary for girls to know about? (check all those relevant)

- Word-processing
- Spreadsheets
- Databases
- Communications
- Programming
- Hardware / computer architecture
- Graphics
- Music
- Desktop publishing

Section 5. Administrative Use of Computers

Do you have computer(s) in your office for administrative purposes? If the answer is no, please do not answer the other questions.

How many computers do you have for administrative purposes?

For which administrative purposes do you use the computer(s)?

- Student records
- Accounting
- Timetables
- Immunization
- Grading
- Report cards
- Others (please specify)

Who paid for purchasing the computers for administrative purposes?

- Board of Education
- District of Education
- School
- Parent(s)
- Others (please specify)
APPENDIX B.2: Teacher Questionnaire

Section 1. Background Information:

1.1- Name ............................................

1.2- Your gender. ( ) Male ( ) Female

1.3- Your Age. ( ) (20-30) ( ) (30-40) ( ) (40-50) ( ) (50-60)

1.4- Name of the school. ..........................

1.5- Kind of school. ( ) [boys] ( ) [girls] ( ) [private] ( ) [public]

1.6- Number of years you have been teaching. ( ) (1-3) ( ) (3-6) ( ) (6-10)
     ( ) (10-15) ( ) (15 or more)

1.7- Subjects you have been teaching? ( ) (Math and Physics) ( ) (Science)
     ( ) (Social science) ( ) (Arts and Literature) ( ) (Computer Course)

1.8- The subjects that you are teaching now ..............

1.9- Academic background degree ( ) (Teacher certificate) ( ) (Bachelor)
     ( ) (Master or higher degree)

1.10- Your major field(s) in university? ..................

Section 2. Computer Access

Q- 2.1
Do you have a computer at home? ( ) Yes ( ) No

Q- 2.2
Do you have permission to use the high school lab computers for your personal purposes? ( ) Yes
     ( ) No

Q- 2.3
Approximately, how many students are present in every Computer Studies Course class?

Q- 2.4
How many students work at any one computer station? ( ) One student per computer
     ( ) Two students per computer ( ) Three students per computer
     ( ) Four or more students per computer

Q- 2.5
If a computer is shared by two or more students, what are the students who are not typing on the computer doing?
     ( ) Helping the student who is at the keyboard
     ( ) Participating in the group discussion
     ( ) Looking at other students who are using computers
Software Access

Q- 2.6
What software have you been using with your students? (Please, list the most important software packages).

Q- 2.7
In what language are software packages written? ( ) Persian ( ) English

Q- 2.8
Have you developed any educational software by yourself or with others? [ ] Yes [ ] No

Q- 2.9
Which of the following tool applications (if any) are you using with your students?
( ) Word-processing ( ) Spreadsheets ( ) Databases
( ) Communications ( ) Programming ( ) Hardware/Computer architecture
( ) Graphics ( ) Games ( ) Others (please specify)

Section 3. Teachers' Training Development Courses

Q- 3.1
How did you learn about computers? (Please check all relevant items)
[ ] Preservice training [ ] Inservice training [ ] Private organization workshops
[ ] By yourself [ ] From/with (a) friend(s) or (a) colleague(s)

Q- 3.2
If you have taken any course(s) related to computers prior to becoming a teacher, then please specify, for each course the title, who provided the course, the year and place in which course was taken.

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<thead>
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<th>Course title</th>
<th>year taken</th>
<th>provided by</th>
<th>place</th>
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<td>1-</td>
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Q- 3.3
Have you participated in any inservice training related to computers? ( ) Yes ( ) No
If the answer is no, please go to next section.

Q- 3.4
How many hours of inservice training have you received in total (i.e. in all inservice Computer related courses)
[ ] 1-5 [ ] 5-10 [ ] 10-20 [ ] 20-50 [ ] 50-100 [ ] over 100

Q- 3.5
Roughly, what percentage(s) of these hours involved theoretical material, vs. hands-on work?
( ) % Theory ( ) % Hands-on
Q- 3.6
Who provided the inservice training course(s)?
( ) Your school
( ) Your district
( ) University or college
( ) Private classes, private companies?

Q- 3.7
Who paid for the course(s)?
( ) Ministry of Education
( ) District of Education
( ) School
( ) Yourself
( ) Others [please, specify]

Q- 3.8
What topics were covered in the inservice course(s)? (Please mark all those relevant)
( ) Introduction to computers
( ) Programming
( ) Word-processing
( ) Spreadsheets
( ) Databases
( ) Communications
( ) Others (please specify)

Section 4. Teachers' Attitudes toward Computers
Q- 4.1
Which of the following reasons are the most important for justifying learning about computers in schools?
(You can check more than one answer)
( ) a- Because it helps student(s) to find a job easier
( ) b- Because of the extended uses of computers in society, everyone should have some knowledge about computer?
( ) c- Because, if the students know about computers, they will get higher ranking in the university entrance exam.
( ) d- Because, computer use helps students to think more logically and it will help them in their studies
( ) e- Because, by using computers, changes will happen in teaching and learning style.
( ) f- Because, it is a good instrument for entertainment.
( ) g- Because of other reason(s), (please specify)

Q- 4.2
In your opinion which students should learn how to use computer(s)?
( ) Only boys
( ) Only girls
( ) Both girls and boys.
( ) None

Q- 4.3
In your opinion, which of these areas are important for boys to know about? (check all those that you think are relevant)
( ) Word-processing
( ) Spreadsheets
( ) Databases
( ) Communications
( ) Programming
( ) Hardware/computer architecture
( ) Graphics
( ) Others, please specify

Q- 4.4
In your opinion, which of these areas are important for girls to know about? (check all those relevant)
( ) Word- Processing
( ) Spreadsheets
( ) Databases
( ) Communications
( ) Programming
( ) Hardware/computer architecture
( ) Graphics
( ) Others, please specify
Section 5. Implementation Issues:

Q-5.1
In teaching the Computer Studies Course, what kind of problems did you experience? (Please check all relevant items).

( ) Insufficient hardware
( ) Insufficient software
( ) Insufficient time for hands-on work
( ) Insufficient time for theory
( ) Discipline problems
( ) Lack of student motivation
( ) Students found concepts/skills too difficult
( ) Variations in students' knowledge
APPENDIX B.3: Questionnaires for Students

Section 1. Background Information:
1.1- Your name ..........................
1.2- Your school name ..................
1.3- Age .............................
1.4- What grade are you in? ..........

Section 2. Students’ Access to computers
2.1- Do you have a computer at your home? ( ) Yes ( ) No
   If no, Please ignore questions 2.2 and 2.3.
2.2- Do your parents let you use the computer at home? ( ) Yes ( ) No
   If yes, for what types of activity do you use the computer at home? (please check all those relevant)
   ( ) Experimentation with computers ( ) Computer Assisted Instruction
   ( ) Word-processing (Typing) ( ) Programming ( ) Game(s) ( ) Graphics
   ( ) Communication ( ) Others (please, specify)
2.3- For how many hours per week do you use the computer in your home?
   ( ) Less than one hour ( ) One hour ( ) Two hours ( ) Three hours ( ) Four hours
   ( ) Five hours and more

Section 3. Students’ Prior Knowledge about Computers
3.1- Have you learned about computers before taking the Computer Studies course?
   ( ) Yes ( ) No
3.2- How have you learned about computers? Please check all of the relevant items.
   ( ) By private organization(s) ( ) By KAD ( ) By myself
   ( ) By my friend(s) or classmate(s) ( ) Others (please, specify)
3.3- If you have taken any course(s) prior to the Computer Studies course in grade 11 Math and
     Physics, please fill out the course specification.
     Course title  Year
     1-
     2-
     3-
3.4- Have your teachers used CAI programs in their teaching? ( ) Yes ( ) No
3.5- Which of the following computer related areas are you familiar with?
   ( ) Programming ( ) Graphics ( ) Music
   ( ) Communication ( ) Word-Processing ( ) Spreadsheets
   ( ) Databases ( ) Operating system (DOS) ( ) Games
   ( ) Others
**Section 4. Students Attitudes toward computers**

4.1- Which of the following reasons are the most important for justifying learning about computers in schools? (You can check more than one answer)

( ) a- Because it helps students to find a job easier
( ) b- Because of the extended uses of computers in society, everyone should have some knowledge about computer?
( ) c - Because, if the students know about computers, they will get higher ranking in the university entrance exam.
( ) d- Because, computer use helps students to think more logically and it will help them in their studies
( ) e- Because, by using computers changes will happen in teaching and learning style.
( ) f- Because, it is a good instrument for entertainment.
( ) g- Because of other reason(s), (please specify)

4.2- In your opinion which students should learn how to use computer(s)?

( ) Only boys
( ) Only girls
( ) Both girls and boys.
( ) None

4.3- In your opinion, which of these areas are necessary for boys to know about? (check all those that you think are relevant)

( ) Word-processing
( ) Spreadsheets
( ) Databases
( ) Communications
( ) Programming
( ) Hardware/computer architecture
( ) Graphics
( ) Operating system
( ) Others(please, specify)

4.4- In your opinion, which of these areas are necessary for girls to know about? (check all those relevant)

( ) Word-processing
( ) Spreadsheets
( ) Databases
( ) Communications
( ) Programming
( ) Hardware/computer architecture
( ) Graphics
( ) Operating system
( ) Others(please, specify)

4.5- In your opinion, what should be done in order to motivate students to learn about computers?

( ) Questions from the computer course should be included in the University Entrance Exam.
( ) Teaching about computers should be started in the elementary and guidance level
( ) Teaching about computers should be started in the grade 9 and then continue in grade 10 and 11.
( ) More lab facilities should be available.
( ) Students should have more access to computers.

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**Section 5. Implementation Issues**

5.1- What kind of problems have you experienced in relation to the Computer Studies course? (Please check all relevant items).

( ) Technical problems with the hardware and software
( ) Insufficient hardware
( ) Insufficient software
( ) Insufficient time for hands-on work
( ) Insufficient time for theory
( ) Lack of motivation
( ) Concepts and skills are too difficult
( ) Variation in students' knowledge

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1. Interview Schedule for the Ministry officials

Interviews with Ministry officials included the process by which computers were introduced into the Iranian schools; policy development, existing policies, implementation process, teacher training, problems encountered, etc. Following are some of those questions:

1.1. Could you please explain the process of the introduction of computers into the Iranian education system?
1.2. What was the rationale for the introduction of computers into the Iranian high schools?
1.3. Why did the Ministry of Education decide to introduce the Computer Studies course?
1.4. How and when did you start to implement computers in the Iranian high schools?
1.5. Describe the factors that influenced the choice of schools and teachers that became involved with computers, and those which did not.
1.6. What was the general attitude towards computer use at the beginning?
1.7. Were the administrators of the other provinces involved in the planning process?
1.8. What do you think about the consensus of other provinces' administrators?
1.9. Describe the cooperation of the other provinces with the Ministry of Education.
1.10. Did the administrators from other provinces have any opportunity to be acquainted with the objectives of the Computer Studies course?
1.11. Did you arrange any inservice training courses for administrators from other provinces?
1.12. What feedback did you receive from the provinces during the implementation of the Computer Studies course?
1.13. What problems did you have in the beginning?
1.14. How do you compare the problems of the first year of implementation with those of subsequent years?
1.15. What was the role of the Iranian Ministry of Education during the implementation process?
1.16. What experiences of the introduction of the Computer Studies course would be useful in the future planning for computer use?
1.17. What are the other uses of computers in the Iranian education system?
1.18. What have been the benefits and drawbacks of using computers in the education system?
1.19. In the future, how do you expect computers to be used in the Iranian high schools?
1.20. If you could plan for the use of computers in the school system with unlimited sources, what plans would you make?
1.21. What do you think about the future of computers in the Iranian society?

2. **Interview Schedule for Principals, Computer Lab Managers, and Teachers**

**Policy Issues:**
2.1. Do you have any special guidelines for using computers?
2.2. Are teachers free to work outside the guidelines for using computers?
2.3. Had you participated in the planning of the Computer Studies course?
2.4. Are you clear about the objectives of the introduction of the Computer Studies course?
2.5. What was your responsibility in the implementation of computers?
2.6. Are you clear about your duties in your job?
2.7. What are the roles of the Board of Education and Districts of Education in the computer implementation?
2.8. Who provides monitoring and problem solving?
2.9. Who provides for repair and maintenance of computers?
2.10. What types of support did you receive during the implementation process?
2.11. What do you think about the support? Was it sufficient?
2.12. Did you have a chance to receive considerable local support?
2.13. What kinds of support have the districts provided for more successful use of computers?
2.14. What were the roles of parents and community support in this innovation?
2.15. What kinds of other support do you need?
2.16. Have you ever used computers in your work? If not, why?
2.17. Have you ever used computers for administrative tasks?
2.18. Are you clear about the objectives of using computers in administrative tasks?

**Clarity about Objectives:**
2.19. What are the objectives of the Computer Studies course?
2.20. Do you agree with the objectives of the Computer Studies course?
2.21. Do the objectives of the course match your expectations?
2.22. What do you think about the outcomes of the Computer Studies course?
2.23. What do you think about the positive effects of using computers in the Iranian educational system?
Inservce Training Courses
2.24. What is the major source of your computer knowledge?
2.25. Have you ever participated in the computer inservice training courses?
2.26. What types of teachers can participate in the computer inservice courses?
2.27. What privileges are there for participants in the in-service training courses?
2.28. What subjects are included in the computer inservice training courses?
2.29. Describe the method(s) of teaching used in the inservice course(s) you attended.
2.30. Do you think that you have enough knowledge to do your job?
2.31. What are your suggestions for improving inservice courses related to computers?
2.32. Is there enough support for teachers to learn how to use the computer?
2.33. Is there enough time for teachers to learn how to use the computer?

Implementation Issues in Using Computers
2.34. Do you have enough access to computer related resources?
2.35. What problems if any, do you have in relation to maintenance?
2.36. What are the problems if any, related to the available software?
2.37. In what language is the software provided?
2.38. What suggestions do you have about available software?
2.39. What is the most important factor for more effective use of computers in schools?
2.40. What problems if any, did you have in the first year of implementation of the Computer Studies course?
2.41. What are the problems in this phase?

Attitudes towards Computers
2.42. Are you comfortable with computers?
2.43. Do you think that computers are important in Iranian schools? If so, why?
2.44. How do you think computers should be used in Iranian schools?
2.45. What cultural factors are important in using computers in education?
2.46. If you were teaching in both gender high schools: What differences between boys and girls have you observed in the Computer Studies course?
2.47. How can you describe the existing differences which you observed?
2.48. Are there any gender issues in the Computer Studies course?
2.49. How can you describe the role of socio-cultural factors in the computer implementation?
3. Computer Teachers' Interviews Regarding the Computer Studies Course

3.1. Is the content of the Computer Studies course adequate?
3.2. Do you have any suggestions about the content of this course?
3.3. Do you think that the format of two hours theory and one hour practical is appropriate?
3.4. Which computer applications other than programming are you familiar with? Specify which of these you have used with your students.
3.5. What do you think are the learning outcomes associated with the Computer Studies course?
3.7. Do you think that this course helps students in learning mathematics or physics, or other subjects? If yes, then how?
3.8. Do you think that this course will help students in finding a job easier?
3.9. Do you think that your teaching has been changed as a result of teaching the Computer Studies course? Could you please explain what kinds of change have occurred in your teaching style as the result of using computers?
3.10. Do you think that computers changed the relationship between you and your students? If so, how?

4. Students' Interview Schedule

4.1. What do you think about the objectives of the Computer Studies course?
4.2. What did you expect from the Computer Studies course?
4.3. Does the content of this course match your expectations?
4.4. What are your suggestions for using computers in Iranian high schools?
4.5. What problems did you experience (if any) during the Computer Studies course?
4.6. What gender issues (if any) exist in using computers in Iranian society?
4.7. What kind of gender differences (if any) could you see in your parents' behaviors?
4.8. Do you think that there is a difference between men and women in terms of their capabilities?
4.9. Do you think that there should be any difference between boys and girls curriculum?
4.10. What do you think about gender issues in society?
4.11. Do you think that taking this course could help you to find a job easier?
4.12. How could you use the knowledge acquired from the Computer Studies course?
4.13. In your opinion, what factors impact on the success of introduction of computers into Iranian schools?
4.14. What social factors are important in using computers in the Iranian education system?
5. Parents' Interview Schedule

5.1. Do you have a computer at home?
5.2. For what purposes did you buy the computer?
5.3. How often do you use the home computer?
5.4. Do you use computers in your job? For what purposes do you use computers in your job?
5.5. Do you have any background knowledge about computers? Please specify the training courses which you have taken.
5.6. Who arranged the computer in-service training for you?
5.7. What do you think about children's learning about computers? Is it important for them to learn about computers? If yes, why?
5.8. What is your rationale for children to learn about computers? Why do you think that students should learn about computers?
5.9. How could your children use the acquired knowledge from the Computer Studies course?
5.10. What do you think about the Computer Studies course?
5.11. Do you think that your children's schools provide enough instruction about computers?
5.12. What suggestions do you have about the Computer Studies course?
5.13. If you had responsibility in the Ministry of Education, what changes would you have made in the Computer Studies course?
5.14. What do you think about the future of computers in Iran?
5.15. What cultural factors are important in using computers?
5.16. Do you think that there should be any difference in curriculum between boys and girls?
5.17. In your opinion, which gender should learn about computers? Boys, girls, or both.
5.18. In which areas of computer science do you think boys are better than girls?
5.19. What areas of computer knowledge do you prefer for boys to learn about?
5.20. What areas of computer knowledge do you prefer for girls to learn about?
5.21. Do you think that there should be any difference in the curriculum between boys and girls according to their abilities?
5.22. If you have a limited budget, do you prefer to spend money on your boys, or on your girls?
5.23. What kinds of jobs do you prefer for girls?
5.24. What kinds of jobs do you prefer for boys?
5.25. How do you support your children's schools in the field of computer education?