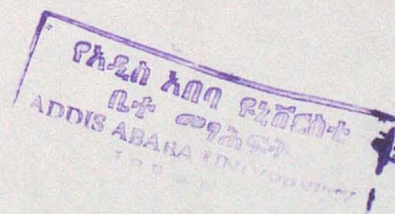


ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

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SCHOOLS IN USING COMPUTERS FOR
SUPPLEMENTING INSTRUCTION**

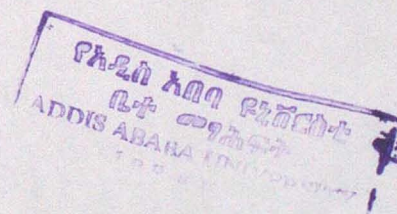


BY
DESALEGN SHERKABU ABADAMA

JUNE, 2004

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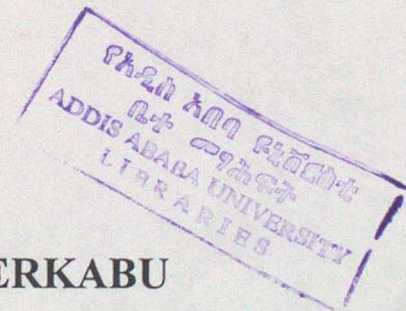
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**A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF
ADDIS ABABA UNIVERSITY IN PARTIAL FULFILMENT OF THE
REQUIREMENT FOR THE DEGREE OF MASTERS OF ARTS IN
CURRICULUM AND INSTRUCTION**

BY: DESALEGN SHERKABU



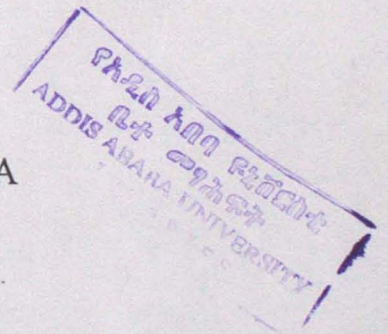
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TO THE MEMORY OF MY FATHER SHERKABU ABADAMA AND MY BROTHER
MANDEFRO SHERKABU

ACKNOWLEDGEMENTS

A special express gratitude goes to Dr. Temechegn Engida (Asst. Prof. At UNESCO ICBA and AAU). He deserves my deep respect for his extraordinarily genuine advisee-ship.

I am also very much indebted to the following two educators. First, I would like to thank Ato Amare Asegedom (Associate Prof. at AAU) for his proper guidance during the early conception of the broad idea, which latter was modified to the present title of the study. Next, Ato Shimekit Lemma (Associate Prof. at Saint Mary's College) shall earn no less for his valuable comments while I was working with the study.

Lastly, I also owe a big deal to those who gave me their valuable comments throughout the research period. Worth mentioning in this connection is Ato Abera Megerssa (MA).

ACRONYMS

CAI	Computer Assisted Instruction
NETP	New Education and Training Policy
ESDP	Education Sector Development Program
IT	Instructional Technology
ICT	Instructional Technology (<i>Information Communication Technology</i>)
MOE	Ministry of Education
MS.C.P	Microsoft-Certified Partner
PC	desktop computers those are mostly available in Ethiopia today.

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Abstract

This study aimed at evaluating the experiences of Addis Ababa and Awassa non-government second-cycle primary schools in using computers for supplementing instruction. To realize this, data were collected using series of interviews and an observation coding-sheet. Accordingly, 15 CAI and 15 non-CAI teachers 4 principals, and 32 students (i.e. with a focus group of size 8) in each of the 4 schools were chosen all based on availability sampling technique except the students who were chosen using purposive sampling. The researcher too participated in responding in some form.

The interview items underwent a test for face validity and trial on representative sample students, and the rating scale too was thoroughly tested for item correlation and for its internal consistency using Pearson's product-moment correlation coefficient formula. Then the actual data from the interviews were analyzed using a strategy called matrix analysis. The quantitative data were analyzed using the F test and its further technique of analysis- the Tukey test for comparing the difference among the group means.

It was found that the little practice of offering CAI in the target schools began in a haphazard way where the schools had made no or little needs-assessment as to the use of CAI in their scenario. In fact, the schools attempted to manage cost-prohibitiveness using the available computers and the resource persons for their secondary school students. These appeared to have somehow deluded the schools and hindered them from considering other low-cost but highly effective instructional mediums, such as audiocassettes combined with print materials. Of course, the educational software showed big irrelevance to the target curriculum in that for example, they failed to take the maturity level of our students into consideration. Even then, all the students and almost all the teachers had an amazingly positive view to CAI.

Thus, it was recommended that the schools make needs assessment first and provide teachers with advanced computer use. MOE should work on a policy directed toward the training of competent CAI instructional designers in the teacher education institutes of the country. Finally, these bodies should not get late in making advantage of the amazingly big interest of Ethiopian primary school learners and teachers to CAI, for improving the quality of education through introducing the technology.

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

The Ethiopian education is entangled with complex problems of relevance, quality, accessibility and equity (NETP, 1994). In this connection, the most notable impediment was the fact that our education over the last century was characterized by education for its own sake. It was indeed a type of education not only little appealing to the interest of the individual child, but also lacking creativity to solve the problem of the child and the nation as well. Obviously, this was alongside found provoking an even poorer quality of educational provision from time to time.

In responding to such painful problems as the above, the ESDP II (2001/02) stressed on maintaining quality of instructional provision. An important strategy in this regard has been the employment of instructional technologies in the education system. Instructional technology has had different forms at each level of social progress in human history. For example, according to Finn (1972), the invention of writing on clay tables five thousand years ago formed the basis for the creation of paper and then the printing machine. Later developments in the field went on in the form of different audio visual aids, teaching machines, computer-assisted instruction, and very lately into instructional provisions through hypermedia including the Internet.

On the other hand whether we like it or not, the world has already entered the era of computer-assisted activities and today we have what are called computer aided manufacturing, computer aided drafting, computer aided instruction, etc, (Hebenstreit, 1988). Computer-aided-instruction

is also commonly referred to as Computer-Assisted-Instruction (CAI). According to Heinich, et al. (1996), it is an extension of programmed instruction.

The latter arranges materials to be learned in a series of small steps designed to lead the learner through self-instruction from what she/he knows to the unknown of new and more complex knowledge and principles. CAI is developed based on operant conditioning originated by B.F. Skinner in his theory of behaviorism. As a single branch of the late programmed instruction, it refers to a situation in which a computer is used by itself to instruct students or as a supplement to the traditional teacher-directed type instructional provision (Wakshum, 2001). As is stated in Beach (1997), CAI is a kind of computer software that provides students with the opportunity to practice basic skills (such as solving mathematics problems or matching terms and meanings) and normally provides immediate feedback on accuracy of performance.

A multitude of terminologies that slightly overlap with CAI like Computer-Based-Education (CBE) will make the meaning of CAI a bit difficult. A detailed discussion for these meaning variations and similarities is found under the literature review section of this study. Irrespective of its meaning coincidence however, CAI commonly refers to drill-and-practice, tutorial, or simulation activities offered either by themselves or as a supplement to traditional, teacher-directed instruction.

CAI has also a theoretical support from the cognitive psychology. Thinking that the whole is greater than the part, computer multimedia integrates the computer as a display device, management tool and/or source of text, picture graphics and sound. For the cognitive theorists hypermedia resembles the way people organize information with concepts and their relationship, (Heinich et al 1996).

We might ask why do computers draw so much attention of modern world. According to Beach (1997), the goal of having students achieve computer literacy was conceived to help them acquire the necessary skills for entering the work place. This writer noted that encouragement from business and industry had made educators focus on the value of using computers as a form of technology for teaching in the elementary classroom.

The recent world perspective indicates a trend of involving students in hypermedia projects and to promote electronic mail access, giving individuals opportunities to connect with other students and resources around the world. In addition, new views of teaching and learning have led educators to give new emphasis to engaging students in active learning projects using computers as an exploratory tool in learning process. In bringing computers to classroom instruction, more emphasis is placed on providing opportunities for problem solving and co-operative learning methods. According to Heinich et al. (1996), with an increasing ease of operating computers and with the creation of software that provide learners with opportunities to solve complex problems, computers have already started giving a way for schools to be places where to learn how to learn rather than places where to get knowledge.

It is no question that the technology has promoted learning to some degree. Today students can learn many facts on computers. Several other abilities are also being achieved at a better speed than the olden days. For example, a recent summary of research findings from overseas indicates that CAI can be successfully used in schools. According to Cotton (1991), a summary of Stennett's (1985) review of reviews indicated that well-designed and implemented D and P (drill and practice) or tutorial CAI, used as a supplement to traditional instruction, had resulted in improved students' final examination achievements. According to this same review, although the areas on which CAI can be successfully used are not yet fully investigated, it had already

shown superior achievements in areas such as learning rate, retention of learning, attitudes, and other beneficial effects like sense of self-efficacy, attendance, motivation (time on task) and co-operation (collaboration).

As for the acceptance or rejection of the instructional innovation by the learning-teaching society, particularly in the USA it had been noted that the use of computers in the classroom had grown dramatically. There, teachers had reported that using computers in their classrooms had changed their teaching style positively, (Beach, 1997). While computers still generate much excitement in schools (Beach, Ibid), Green (1995:1) as cited in the former cautions that in spite of the technology, schools "Still have joyless programs of organized instruction and countless students who fail. "Among other challenges (Beach, 1997) of teaching with computers is the initial cost of hardware and software. In addition, the dramatic pace of technological change poses a problem of renewing the costly software. The need to prepare teachers and other professional staff members for the use of the computer creates another independent challenge. Adjacent to this is the resistance from teachers against the trying of computers in their teaching.

Nevertheless, according to Arnolds (1999), numerous studies have reported that CAI is successful in raising examination scores, improving students' attitudes, and lowering the amount of time required to master certain materials. In general, there are more evidences that CAI can play a respectful role in keeping up the quality of educational provision in schools at least in the areas that have been proved effective. Among other qualities of CAI is its provision of opportunities to the wider public. For example, according to Cotton (1991), CAI has a better appeal to most students with some learning disabilities, and it benefits those from the economically disadvantaged groups as well as those with lower academic achievements in

meeting individual differences. Still in some studies, CAI is even argued for its cost effectiveness as compared with the conventional way of instruction (Ellison, 2001).

As has been pointed out in the ESDP II (2002), quality of instructional provision is one among the priority issues of the NETP. In line with this, MOE has already been involved in the preparation of improved instructional inputs which in most cases are limited to the production of print based materials in some quantity on the one hand and undertaking the upgrading of teachers' qualification at institutions training teachers still predominantly for the print medium on the other hand.

A point here, however, is whether such endeavors alone could suffice in providing an updated education to the child of this era of computer. In almost a restatement of the previous paragraphs, when the issue of quality educational provision is raised, particularly in the last decade USA, a growing tendency of using computers in classroom instruction has been noted (Heinich, et al. 1996).

In this regard, Posner (1996:37), an American educator, commented that "Computer education curricula are responding to a growing sense that the computer is becoming an important part of our every day life and that computer literacy is part of what is now meant to be well educated." This being the overall conception of the importance of computer literacy by our world today, in this era of globalization it is generally of no value for countries like Ethiopia to get themselves alienated from the technological advancement of the rest of the world. It appears cognizant of this fact that the Ethiopian government has already mounted on adopting different instructional technologies such as education through the medium of TV via Satellite and secondary school computer laboratories that are networked with the W.W.W, (EMA, 2003).

Furthermore, some private schools use computers in their educational provision in some form of CAI. To mention some Sanford International, German Church School, and Supper Holly Savior Primary Schools in Addis Ababa and SOS Primary Schools in Awassa are found to use computer CDs for instructional purposes.

This little use of computers in the Ethiopian primary education schools, just like in most other sectors of the nation until very recently, is attributed to inadequate quality of computer staff, lack of appreciation of the service by top management, and inadequate feasibility studies (Girma, 1996). In this connection, what should be given a priority is carrying out series of studies in the area in a way that the desired change can get enough ground to step on. Therefore, the present researcher set his task to assess the existing endeavors of the available schools for appraising the timely technology in the field of instruction, on the one hand, and to get the experiences shared by other schools of the nation too.

1.2. Statement of the Problem

Improving the current quality of its program is the foremost priority of the Ethiopian education system (ESDP, 2001/02). This has called for the use of instructional technologies in schools. Parallel to the ICT that the Ministry focused on, CAI is an "alternative" technology in the field of instruction. Most technologies, however, are not without limitations. For example, many studies had been positive to CAI effectiveness. But they are also either indifferent to or against it on such yardsticks as classroom achievement test results, and in fact in cost-prohibitiveness, as well as in the dehumanization fear that might result from an over use of the machine. Even then, all these suspicions on the technology appear to have little resulted in a disinterest to its

use. Of course, a number of our school in the private sector are rushing to employ computers in their classrooms for whatever reason that need undergo careful investigation.

At the same time whereas the researcher has a strong belief over the need of carrying out a feasibility study before all attempts of diffusing and/or adopting CAI into every education system, he found not enough research in the area to have ever been done in Ethiopian as well as African context through out the literature review he made. Sophisticated feasibility studies in the context of this study can only take the form of either cost-benefit analysis or developing a workable system design. The first form above as mentioned in most literature, such as Veigas (1962); Lancaster (1997:1); and Abebe (1993) is often difficult to do. No question the second form requires a sophisticated knowledge of computer programming and system operating which includes designing and analyzing computer systems, as well as being a devoted instructional. By putting aside these sophist tasks for future interested researchers of that type, the writer of this paper aims at assessing the little experience of our schools in using computers in their instructional provisions just from the perspective of instruction.

As regards to the above, success in employing educational technologies such as CAI heavily depends on the quality of instructional software (Heinich et al. 1996) on the dispositions of teachers (Rogers and Eichholz (1964); Beach (1997), as well as the reactions of the learners Rowntre (1982). In such a connection, appraisal of programs through a genuine assessment is clearly mandatory for later improvements following the consequent feedback. The investigator then examined the efforts in employing computers for supplementing the instructional provisions in some selected non-government primary schools of ours.



To this effect, the investigator has set the following basic questions:

- i. What procedures do Addis Ababa and Awassa Non-government primary schools under reference follow in employing computers for supplementing instruction?
- ii. How do they manage problem of cost prohibitiveness?
- iii. How much and how well are computers in use in the subject primary school?
- iv. How much appropriate are the computer-assisted instructional programs in use by the subject schools?
- v. What is the reaction of the students to the programs?
- vi. What is the reaction of the teachers and school principals to the program?

1.3. Purpose of the Study

This study aims at evaluating the experience of Addis Ababa and Awassa non-government second-cycle primary schools in providing CAI. It does so because in case the experiences deserve praise, all other Ethiopian non-government primary schools will get it an important basis for adopting the instructional technology. On the contrary, if the experience shows failure the study will point out this and suggest solutions.

1.4. Significance of the Study

The full analysis of this paper is believed to:

- i. Provide educators and other concerned bodies with information about the state of computer use in Addis Ababa and Awassa non-government primary schools for supplementing instruction.
- ii. Provide the school running the program with a genuine appraisal in case they deserve it.
- iii. Provide our policy makers with good ground to introduce CAI in the primary schools.

- iv. Initiate other researchers to accomplish further research in the area.

1.5 Scope of the Study

This study focuses on examining the experience of Addis Ababa and Awassa non-government second cycle primary school in using computers for supplementing instruction. Thus although the experience can have implications to all levels of other schools in the nation, the findings and conclusions that will be reached at will only be directly applicable to the Ethiopian Non-Government Private Schools.

1.6 Limitations of the Study

Of course, this study would be better dependable if it included all Ethiopian non-government primary school with their various level use of computers for supplementing instruction, but time denied the researcher of this broader scale researching.

This study shares at least one limitation of Likert-Type scales. It is the difficulty of establishing a neutral point and consequently a neutral score on the scale. According to Oppenheim (1972) as cited in Kravas-Doukas (1996), the neutral point is not necessarily the midpoint between the extreme scores. For her this is because a respondent can obtain a middle-of-the-range score by either being uncertain about many items or by holding inconsistent or strongly satisfying and strongly dissatisfying scores towards the object quality under investigation. Thus, the following assumption can be taken for a limitation of this study. The midpoint of the range in each scale category was assumed or taken as its neutral or middle score throughout this paper.

1.7 Definition of Terms

In this study, the following terms and phrases have been used as described bellow.

CAI: refers to using computers and educational software to supplement the teaching of school subjects other than basic computer skills.

Innovation: refers to a new way of carrying out an instructional provision using CAI.

Nongovernmental Second Cycle Primary Schools of Ethiopia: refers to those schools in which Ethiopian students attend basic primary education using the Ethiopian curriculum with or without any modification or addition. Here second-cycle refers to the grade levels five through eight.

Attitude: refers to the mode of thinking with which students and teachers approach CAI.

Cost of a technology in use: the average cost per student study hour for a particular technology to teach a given number of students over the expected life of courses to be delivered supported by the technology. (Sparks 1984 ; Moore 1990 ;Bates1995).

Appropriateness: refers to the extent to which the unique educational characteristics of each technology match the learning and teaching requirement. (Schramm 1977; Gagne 1989)

Interactivity: refers to the extent to which the two-way communication between the learner and the instructional software.

User friendliness: refers the extent to which the IT being employed is easy to be used by the learners.

Computer lab- refers to rooms in which computers are placed for use by schoolteachers and the students during their CAI and related lessons.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

In this section of the thesis, the writer summarizes the theoretical basis of CAI, its different applications followed by empirical evidences as to related advantages and limitations, as well as the necessary conditions for effective use of the program. In addition to these, conditions that are necessary for the implementation of innovation and the place of educational technology in the NETP were be reviewed.

2.1. Theoretical Foundation of CAI

Under this sub-heading the support that CAI has from the behavioral and cognitive psychology were treated in brief.

2.1.1. Support from Behavioral Psychology

CAI is an extension of programmed instruction that arranges materials to be learnt in a series of small steps designed to lead the learner through self-instruction from what he knows to the unknown of new and more complex knowledge and principles. It is developed based on Operant Conditioning originated by B.F. Skinner in his late theory of behaviorism. As a single branch of the late programmed instruction, CAI refers to a situation in which a computer is used to instruct students. In CAI, computers are involved in a process of offering instruction either by themselves or as a supplement to the traditional teacher-directed type instructional provision (Heinich et al, 1996, Beach, 1998, Ellison 2001 and Wakshum 2001).

2.1.2. Support from Cognitive Psychology

Of course, CAI had its origin in the work of the extreme behaviorists and particularly in Skinner's theory of Operant Conditioning. However, this does not mean that other schools of thought disregard it. Here it will be much appropriate to try to explain the position of cognitive psychologists with regard to CAI. The two had a lot to do with each other. In this regard, Temechegn (2001:20) noted the following:

Cognitive theory began to develop at about the same time that computer science became important. The parallels between computer functioning and the operation of the brain were so fascinating to cognitive psychologist that another label of cognitive theory emerged, which is information-processing theory. Researchers interested in the area of study began to think of learning in terms of sensory input, encoding, and retrieval systems, using the same terms and models computer scientists used...

The above close resemblance between the cognitive psychology (information processing theory of learning) and the working of computers can be found in the works of, such writers as Gardner (1986) and Gagne (1992). For example, basic model of learning and memory below developed by Gagne provides a clear illustration of the existing relation between the above two concepts.



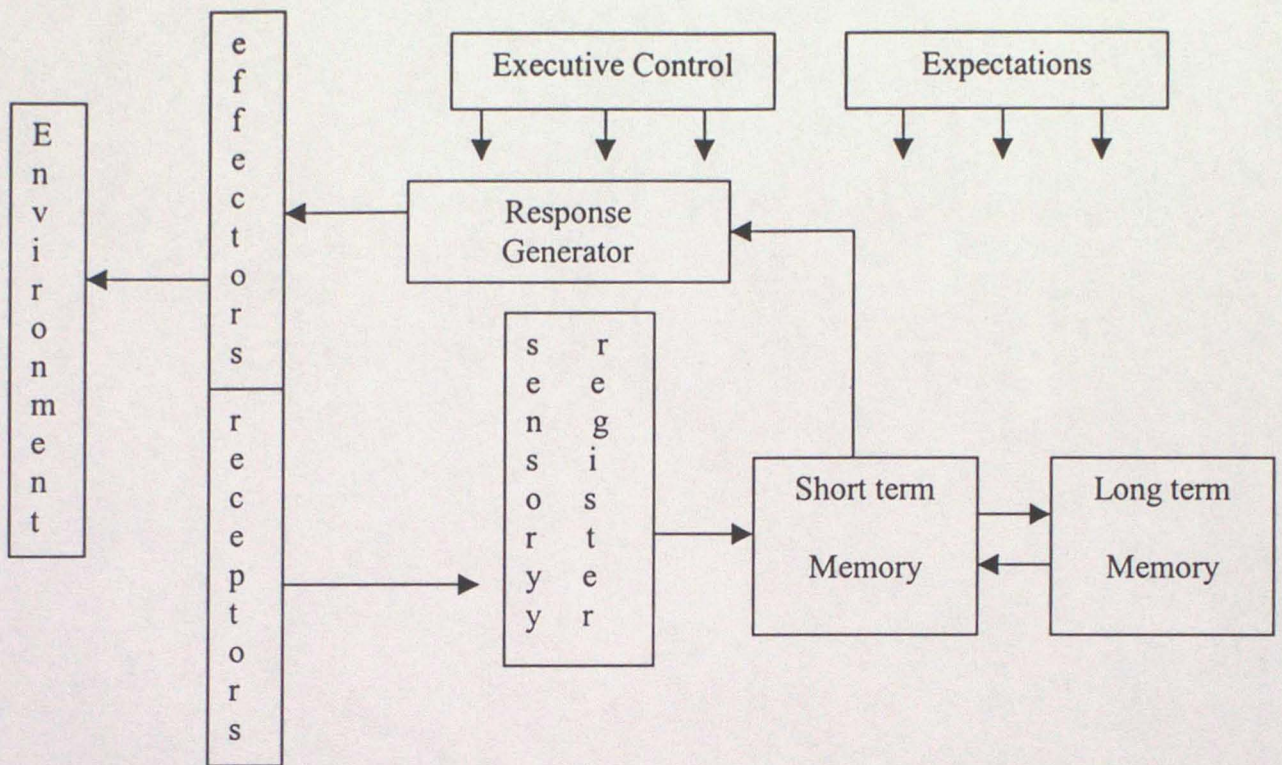


Fig 1. A basic model of learning and memory, underlying modern cognitive (information processing) theories by (Gagne, R. 1992).

In this way as a scientific study of the thought process, Temechegn (2001) calls it, cognitive psychology had its central focus the nature and organization of knowledge as well as how it is acquired. Existing knowledge influences how new knowledge is built. Cognitive theorists accept that the child has many genetically "prewired" neural connections in place to build on. As the child interacts with the world, he or she recognizes these connections in a meaningful manner.

Thus, it will be quite simple to think of what working on programmed computers has to do with both Piaget's theory of epistemology as well as knowledge through insight. Even on some points, it will be difficult to identify whose position is working in given CAI applications. For example, a child, after a continuous drill-and-practice session of basic arithmetic's might gain an insight.

For example, he/she may realize that it is not only $3+5$ or $7+1$ that add up 8, but $2 + 2+2+2$ can also amount the same. Here while the drill and practice is an important learning strategy, which is highly advocated by the behaviorists, the insight in the middle is also highly favored by the cognitive psychologists. In such infinite cases, cognitive psychology advocates instruction to be assisted by computers.

More on this, in their fundamental argument that the whole is greater than the sum of the parts, the cognitive theorists argue for computer-assisted multimedia.

In sum, although the piece-by-piece approach of presenting information identifies the position of the behaviorists from the holistic approach of the cognitive theorists, CAI has a strong theoretical support from both.

2.2. Applications of CAI

Here under, were discussed how CAI functions, its common strategies and the study of computer for its own literacy purpose.

2.2.1. How Does CAI Function?

Several writers have attempted to discuss the instructional application of computers in a more or less similar ways except that some of these discussions are exhaustive. CAI as defined by Aggarwal (1996:365) implies the systematic control of instruction by computer. It is characterized by testing, diagnosing, learning, and prescription and through record keeping. In a more detailed explanation by Beach (1997), CAI involves activities such as solving math problem or matching terms and meanings and the provision of such practice and normally provides immediate feedback on accuracy of performance.

In his comparison of related terminologies Cotton (1991) writes about computer-based education (CBE), computer based instruction (CBI), computer-assisted instruction (CAI), computer-managed instruction (CMI) and Computer-enriched instruction (CEI). Accordingly, while the first two are broadest terms and can refer to virtually any kind of computer use in education. CEI is defined as learning activities in which computers generate data at the students' request, execute programs developed by students, or provide general enrichment in relatively unstructured exercises designed to stimulate and motivate students.

For Cotton, CAI differs from CMI in that the former is a narrower term and most often referring to drill-and-practice, tutorial, or simulation activities offered either by themselves or as a supplement to traditional, teacher-directed instruction. In contrast CMI can refer either to the use of computers by school staff to organize student data and make instructional decisions or to activities in which the computer evaluate students' test performance, guides them to appropriate instructional resources, and keeps records of their progress.

In almost a restatement of the last sentence, Heinich et al (1996) wrote that CMI with a little difference from CAI could serve both the learners and teachers in maintaining information about the students and in guiding the instructional process in sorting information about each student and about instructional materials that can be retrieved quickly. Here the learner may take test on the computer or input information in to a personal portfolio. Further, the computer can diagnose the learning needs of the student and prescribes optimal sequence of instruction for them. In their brief description CAI was put as a system of instruction where a student interacts directly with the computer as part of the instructional activity in the form of materials presented by the computer in a controlled sequence such as drill-and-practice program or as a creative activity that is student initiated, like desktop published book of student poems.

Still according to Alemayehu (1995), computer-augmented learning (CAL), computer-based learning (CBL), computer based training (CBT), computer aided learning (CAL) and computer aided teaching (CAT) are other variations of terminologies under use though their detailed discussion is not found generally to be as such important at least in this paper.

Computer assisted instruction is the most sophisticated, and exciting type of all instructional innovations. It uses programmed instruction, electronic data processing, data communication, communication theory, system theory and learning theory. This makes CAI to be a type of instruction in which a computer is used to present substantial amount of learning material to the student, and to often represent an auto instructional technique enabling students to progress at their own individual rates (Hawes and Hawes, 1982). On the other hand, in spite of the different explanations given earlier on how CAI functions, the following paragraph will form a good narration.

A typical CAI illustration consists of individual learning books, each with a console. The student is seated. Facing him on the console is a television screen for displaying information. Before he starts a program, the student checks in with the computer by displaying his identity number. This connects him with his part of the learning program. A complete package of information stored in the system is presented sequentially. This information could take the form of videotape recordings, slides, motion pictures, films, filmstrips, etc. The student may question the computer and feed answers into it by means of a typewriter keyboard. The computer responds by printing out comments, answers and questions. Sometimes the student may write directly, on the cathode ray tube display screen with a 'light pen'. His answer will be picked up by the computer and evaluated. When he has finished the computer assigns him the next program, records his progress and prints out a report for his teachers, (Pannerselvam, Sampath and Santhanam, 1984:249).

On the other hand, according to Corte, Vershaffel and Lowyok (1984), when the idea of computer in education is raised, it should refer to all environments of which a computer is an integral part. In other words, given the technological convergence of the machine with other media, CAI refers to all new communication and information technology.

Thus, the present researcher views the functioning of CAI in a more flexible manner. In this case, the classroom teacher can use the computer as a means of displaying information to each pupil according to his/her individual pace or interest from a centrally set server or main computer, or through using copies of educational CDs.

2.2.2. Common CAI Strategies

Having a common understanding about what CAI can do as compared with other related uses of computers in education, we can discuss the five common strategies of CAI that follow. They are drill-and- practice, tutorials, demonstrations, simulations and games (Orshalik, 1982; Charles and Hubbard 1992; Corte, Vershaffel and Lowyck (1994); Alemayehu 1995; Girma 1996).

Drill-and-Practice

It is the most common type of CAI with the purpose of providing feedback and practice on skills already learned. It has two phases as a process. In the first, the student is provided with a series of questions and in the second the learner gets confirmation about the correctness of his/her answers or receives diagnostics of mistakes. This form of CAI naturally follows computer tutorials. Although this method is criticized for its pedagogical narrowness (lack of stimulus-response) and for a possibility of reinforcing incorrect learning, its advocates suggest that it can be made a useful educational experience if it includes graphics, sound and animation. For this group the weakness lies more in the poor designing of the programmer (educator) than in the inherent nature of drill-and-practice (Alemayehu, 1995).

Much as it is common in skill training courses, drill-and-practice can have a wide contribution in helping children learn alphabets, and number, basic arithmetic's, and basic science. Hence, it can be a useful aid for classroom instruction in primary schools.

Tutorials

These involve presentation of information. They typically consist of discussions of concepts or procedures with interspersed questions or a quiz at the end of the discussions. As time went on, computerized tutorial programs have been enhanced from their simple forms such as "books on a screen" that present the student with a sequence of displays consisting of all that follow. These include text and graphics, which defined the lesson, and a group of questions and feedback, to a better interactive form in which the student can respond to decide whether to repeat the material, allow him to branch to the next sections of the tutorial, and through providing the student with additional information. The critics of computerized tutorials point out its "limited and limiting pedagogy" as well as the trivial and narrow nature the program in that it limits the range of possible responses for given conceptual questions (Hendrickson, Janson and Rossi in Alemayehu 1995).

As is clearly put above, the nature of this form of CAI appears of paramount importance, especially in better replacing the traditional or teacher-directed approach of transferring concepts from the teacher to the to be taught. While the suggested criticism over computer tutorials is something only to be tolerated the program is, nevertheless, very helpful in teaching humanities in primary classrooms.

Demonstration

Particularly in science and mathematics, primary classroom lessons can be made so easy to such an extent that learners demand little proof. Aided by graphics, sound and color features of a computer, demonstration CAI has a much richer potential to be interactive than do chalkboard or overhead-projector-demonstration in that variables are more easily manipulated; effects are instantaneous; graphics are clearer than chalk marks; and the working surface are cleaner than a board (Merril et al., 1986 in Alemayehu, 1995 and Girma, 1996).

Computerized demonstration as a method allows learners to get a hands-on or face to face first hand experience. This will be then an important mechanism of getting primary classrooms become much more rich environments than ever in the history of education.

Simulations

In simulations, objectives are specified and information about a given process will be presented. This is done with a purpose of teaching the learner to identify and control the relationship among different components of the system while trying to reach certain goals. In the process, the student will be given feedback regarding the consequences of his actions or responses (Hendrickson, Janson and Rossi 1985 in Girma 1996).

While simulations are based on model of some process, mechanism or activity, they cannot fully represent reality. As a result, learners are only made to focus on certain aspect of the process under investigation. Moreover, the designing and programming of a good computer simulation is very difficult. In addition to this, the inherent difficulty that exists in representing real world problems with models counts for a main criticism of computerized simulation. However,

simulations are powerful learning tools in studying events that could not be otherwise examined owing to danger, expense, or lack of time (Alemayehu, 1995).

From the above discussion, one can learn that primary classrooms can make advantage of simulation in the instruction of such lessons as foreign language, humanities, and science and technology to mention the least. In short, computerized simulations can be very useful for primary classrooms.

Games

Most appropriate in situations where learner motivation is the concern and this is obviously to point out that children are naturally found in their world of play, computerized instructional games involve an element of fantasy which is not possible in the other types of CAI applications discussed above. Games are designed to be fun for students and thereby increase the chance of the student learning the concept, knowledge or skill embedded in the game. While games have been noted for their motivational and unique effect above, it should, however been recognized that designing and developing instructional games involving challenge, fantasy and curiosity characteristics requires sophistication in both curriculum design and computer programming (Alemayehu, 1995).

In sum, besides using a different approach and methodology, each of the five CAI programs above are used at different stages of the learning process. The tutorials tend to replace formal lecture education; drill-and-practice complement and develop skills that are already learned while simulation-game is generally a final step towards integration and effective use of skills in problem solving. Thus tutorials, drill-and-practice sessions, simulations and gaming each play an



important role in the educational process that leads from general principles to their factual use in pseudo-real situations.

2.2.3. Computer for Its Own Literacy Purpose

In addition to its direct application to assist the teaching of primary school subjects, a computer in school can serve as an object of instruction as in courses on computer literacy and computer science. In addition, it can be used during instruction to do computer calculations, data manipulations, word processing, and presentations.

At this point it seems appropriate to put the argument of an Ethiopian primary school computer lab technician that the writer of this paper noted during the initial school-to-school visit. According to this professional, it is a very worrying fact that so far in our country the computer is little utilized more than for word processing. He added from his studies in his school days there is 99% more application of computer functioning in the science. The writer with his little reading agrees much with the opinion forwarded.

On the other hand, when explaining the nature of computer literacy courses, Heinich et al. (1996: 228) wrote the following.

Most computer literacy instructions incorporate three types of objectives- knowledge, skill and attitude. The knowledge objectives typically include understanding terminology, identifying components, describing applications, and ethical issues concerning the use of computers. Skill objectives typically include keyboarding and the ability to use computers for a variety of applications, such as words processing, search databases, and retrieving information. Advanced applications include desktop publishing and problem solving. Attitude objectives focus primarily on acceptance of the computer as a valuable tool in the work place. Further objectives might deal with exploring computers as a productivity tools in personal and professional activities.

In short, computer literacy has a multisided advantage for learners in that it will create access to the huge world of information and to the proper skill of processing it with speed and accuracy.

2.3 Research Works over CAI Effectiveness

The writer of this thesis has searched publications of almost all types including unpublished copies of different articles, local and international journals, available theses and dissertations, books, encyclopedias and web sites. Regardless of his global search, the writer little succeeded in finding previous research works done on CAI in the African context. As a result, this thesis will be heavily depending on investigations on very different environment from the Ethiopian school. Of course, it would have been much appropriate to carry out an experimental research to investigate the effectiveness of CAI on the academic progress of Ethiopian students, but this is a huge research project requiring a much higher competence and investment. However, as has already been argued in the background section of this paper it is hazardous in itself to ignore the technological advancement of the world in all fields and particularly in education. In the next sub sections, the writer revises the findings over CAI use.

2.3.1. Advantages of CAI

Promoting or at least introducing computers into schools has social, vocational, pedagogic and catalytic rationale. CAI is highly interactive to the learner (Hawkridge, (1990) in Linden, (1994). For Kawkrige catalytic rationales appear more or less alike with what Goodlad, Toole and Tyler (1996) discuss as follows. One among the compelling forces in bringing computer technology to education is the seemingly endless expansion of enrollment and the inadequate supplies of qualified instructional personnel. In addition to this are the need for getting readily available data of various natures for growing number of researchers, and the need for public request of increased productivity with a reduced cost and greater efficiency.

Some of the advantages of CAI over the conventional classroom instruction are saving time, learner control (self pacing), reinforcement, private learning, special needs fulfillment, visual appeal, record keeping, proper management of the information explosion, diverse experiences. It is also known for its consistency in the type of instructional offering, effectiveness and efficiency, communication precision, and possibility for teachers to develop their own customized computer-based-learning programs (Kehler 1982; Kinzer, Shrewood, and Bransford, 1986; Heinich et al, 1996; Arnolds, 1999; Ellison, 2001).

More precisely, when arguing in favor of IT's which include CAI itself, Wakshum (2001:32) wrote to say, "The interactive learning environment that chiefly implements IT's provides favorable ways of teaching which human teachers could not perform." By focusing on this interactive advantage of IT's again including CAI, the writer above noted three major characteristics of the program, which are interaction, flexibility, and capacity of meeting students' needs.

In almost a re-statement of the arguments above Cotton (1991) puts his own share as next. CAI provides high retention of learning and superior learners' attitudes towards the subject under study and towards themselves. It also helps learners develop self-efficacy, better attendance and learners' motivation as well as feelings of co-operation and collaboration.

On a similar line of argument, we find the review of Wakshum (2001). He had summarized most findings hitherto, to have shown similarities in that they reveal achievements of students learning with CAI to be much better than those in the regular instruction. When subject areas are considered, albeit the effect decreases as we move to the upper grades. Besides students have been found to quickly learn and retain more when taught with CAI than without it. He also puts a

finding by Thomson and Simonson indicating that learning with CAI results in a better attitudinal development of learners not only towards course contents but also to themselves and their instructors and so on. Further, he quoted Lockard, Abrams and Many (1997) to conclude that problem-solving skills had been observed well developed in students who attended lessons using CAI than the regular face to face instruction. Moreover, a review of research findings made by Geisert and Dunn (1991) assumed that the computer is responsive to every learner through making possible the sequencing of instruction to respond to primary and supplementary modality strengths.

As far as the review of the present writer is concerned, almost all scholarly arguments on line and in many other publications appear to unanimously lead towards the advocacy of CAI as a much helpful technology.

In sum it appears that CAI can have the multitudes of benefits mentioned earlier, most of which are supposed to facilitate the applications of modern approaches of instructional provisions. Nevertheless, there are still some points where advantages and limitations seem to overlap. Some such points are presented next.

2.3.2. Disadvantages/Limitations of CAI

In the preceding section, research findings that have argued for CAI use have been listed extensively. However, their argument could be much dubious when viewed from the principle of learning with least-mental-effort effect. According to Amare (1998), as a result of automation man had already begun depending on technology than on one's self (mind or body). The consequence of this obviously is nothing except the creation of a kind of person who depends on technology even when she/he is dealing with little things (i.e. even those things requiring little

thinking or computation skills). Although the writer above directly meant it for television method of teaching, when stressing the inappropriateness of educational technologies such as CAI for developing countries, he summarized the following from Theranian, (1981).

... The least effort principle is the logical consequence of development in the developed countries. In the less developed countries, however, it seems to have been imported in the form of implantation. It preceded the ethics of hard-work, and has created a destabilizing effect on the development efforts of these countries.(Amare 1998b:35)

In a similar fashion, it is common to read about the "limited and limiting pedagogy of CAI" (Humphries, 1982; Alemayehu, 1995; Heinich et al., 1996; and Girma, 1996). The point here is that CAI presentations narrow concepts to the depth and breadth of the actual software developed by a certain programmer or groups of programmers and educator. Besides, according to Heinich, et al, (1996), CAI only provides a controlled environment where creativity is stifled with the computer's slavish adherence of its own program. Lack of social interaction, linear programming, and novelty effect (i.e. the learners' loss of interest as the newness of the approach lasts) form additional weaknesses of CAI.

A continuation of the arguments against educational technologies such as CAI in general is also common in online transmissions and in publications. For example, Ellison (2001) points out those physical problems such as carpal-tunnel syndrome and eye disorders (caused by sitting in front of the computer screen for long periods of time without blinking) as disadvantages of CAI. This idea reminds us with the idea of extreme critics of television as a method of teaching. Neuro-physiological damages that educational technologies such as CAI may have the following forms.

...The process of thinking and discernment becomes semi-functional (at best) when watching television... These authors also presented a finding that a simple, constant, and ambiguous visual stimulus has a negative effect particularly on the left-hand-side of the brain, the area where language communication abilities and cognitive thought are organized... such mental state is known to inhibit organized-thought process" (Mander 1978:39-40, 43 cited in Amare 1998:7-8).

On these points, even though computer screens today have screen covers as an additional device, users need have awareness and take their own care.

Perhaps, the foremost limitations in CAI use are cost issues (Heinich et al 1996, Arnolds, 1999 and Ellison 2001). Among the factors that make cost issues of CAI most sensitive for these writers are given as follows. Cost of hardware coupled with maintenance and repeated up-dating costs, training of software developers as well as the very expensive nature of quality instructional software preparations are real challenges in the area of educational technology use. In the words of Makenzie (1998) as cited in Wakshum (2001) what makes these huge costs even worse is the condition when the expected results are not being met because of teachers' little knowledge and skills about the educational technology.

Let's now see the overlap among advantages and disadvantages of CAI. As a notable advantage, CAI permits teachers to develop customized-computer-based learning programs of their own. CAI is argued for its appeal to diverse needs of learners but it is also argued against due to its problem of inequity. In other words, while some schools having computers buy more and more number of them, those not having one show too slow a progress or not at all (Kinzer, Shrewood and Stanford 1986; Asley 1997 in Wakshum 2001). It has been also argued that CAI is cost effective in that users save money and so on. These might not be fully wrong but at least they sound perplexing to those who are terribly low in purse for the buying of both the hardware and

the related costs mentioned in the preceding section. In one of the subsections next, the writer will explain if there are any economical use of computers for classroom instruction.

2.4 Conditions Necessary for Employing CAI

For many years, the use of computers for the purpose of classroom instruction has been noted limited for reasons such as unavailability of hardware, software and absence of trained teachers and principals to take the initiative to adopt the innovation. In the next few paragraphs, the writer of this paper will discuss human, material and organizational conditions that are required for implementing CAI. These conditions are mainly suggested in Nicholls (1983), Knirt and Gustafson (1986) and Heinich et al. (1996).

2.4.1. Human Resources

From the very task of designing and developing or selecting appropriate computer-assisted instructional program up to the implementation phase, the following group of people play their own role: school principal, teacher, instructional designers, computer programmer and in fact students. Therefore, it appears important that their knowledge and skills about the use of CAI, along with their attitudes toward it given due regard. The next two subsections discuss this.

Knowledge's and Skills about the Use of CAI

It is obvious that students need first know something about the machine (i.e. the computer) and how it functions if they are to make use of it for any instructional purpose. The knowledge and skills that teachers need to have in this regard, can range from simple word processing up to the programming of their own educational software using graphics, sound and animation (Chauhan, 1979; Humphries, 1982; and Milheim, 1998). Aside the other groups, the implication of the

possession of these knowledge's and skills over the innovative inspiration of principals is paramount.

Still a wider view suggests a number of other human factors to possibly affect the innovation rate of employing educational technologies such as CAI. These factors include traditionalism, laziness, fear and insecurity as the major ones. A number of more specific factors include educational bureaucracy, community indifference and resistance, inadequate pre-and in-service teacher education programmers and inadequate knowledge about the process of change (Miller 1961, Carlson 1965 both cited in Nicholls, 1983).

Therefore, it is evident that students, schoolteachers and principals require knowledge and skill about the science of computer and the use of the machine as an instructional tool. However, before one directly plans a teacher-training package in this context, she/he need clearly recognize the role of the classroom teacher in using CAI. Contrary to the fear of schoolteachers that a computer is a threat to their position as a teacher, teachers have many transformed roles in CAI than in the traditional approach (Muller 1968 in Finn, 1972; Sampath et al 1984; and Beach, 1997).

In this regard Bransford and Stein (1984) in Burns, Goin and Tribble (1990) argued that using computers solely as an independent activity for young children may be a mistake. The latter group of writers summarized the role of teachers in computerized problem solving activities as follows. For a meaningful communication with learners, teachers need to provide support and instruction to facilitate problem solving and mastery of software; and to move out of the continuous interactional role as children solve problems independently. Other roles of the

classroom teacher can be summarized from basic questions that a teacher should answer before using a computer in his/her classroom.

Accordingly, the teacher should define objectives clearly; arrange the classroom or the computer center in a way that students can receive help from adults or peers who have expertise with certain computer programs. The teacher should also use a style of teaching that encourages children to become independent problem solvers. S/he should chose a software that fits the teaching of the intended objectives, choosing appropriate format software to achieve the desired objectives, chose a software of appropriate level, making the computer-center available to all children for long enough that they can explore the computer enrichment. S/he further needs to choose the program to start with and the way to introduce the computerized lesson, and provide the children with opportunities of choosing the software to use.

To have a classroom teacher who can effectively and efficiently accomplish the task of integrating computers for instructional use, a pre-service teacher training college with the following objectives is necessary (Bitter and Yoke, 1989).

- i) To create a proficient teacher who is a critical user of current educational technologies, and who recognizes their limitations and future possibilities.
- ii) To create teachers who are competent designers of instructional systems, which will enable them to assist their students to become critical thinkers.

With the above objectives, teachers in their college studies of instructional technologies, for example, can learn many things phase by phase. According to an instructional model for infusing technology in to a teacher preparation program suggested by Bitter and Yoke (1989), the first phase which is an introductory, skill-based program for all education major focuses on providing



practical, hands-on experience with a certain pre-established level of competence. A second and specialization within content areas phase stresses on specific integration techniques, reinforcing the fundamentals learned in the previous coursework. The third and advanced instruction phase concentrates up on a number of courses for undergraduate students to further develop skills in producing instructional systems that can be applied once they entered the field.

Nevertheless, in case of serious lack of teachers knowledge and skills about the technology, user friendly educational CDs can be used for supplementing classroom lessons. In such a case, a computer-center resource person might be of a faire use for small primary schools. In this regard, Burns, Goin and Tribble, (1990:82) noted the following:

Learning to operate a computer to investigate programs for young children is not as difficult as you might think. You do not have to understand complicated programming languages. You have only to learn how to turn the computer on and off, put the program disk in, and push the correct keys to make it run!

However, while there is some truth in the argument above, it is only when proper training is provided to them that teachers will develop a positive attitude and confidence towards effective implementation of CAI. For instance, as Netsanet (2001) puts it, teachers teaching in the Ethiopian Civil Service College use computers only for writing their lecture notes and for preparing research works. She also noted that most of these teachers little visit the computer center of the college for lack of related skills and knowledge. Likewise, Kinzer, Shrewood and Stanford (1986) noted that even in American schools that had considerable numbers of computers only one or two teachers, at most were found to be regular users of CAI. Here it is a question in the mind of the writer if teachers, students and principals attitude towards computer use matter in general.

Attitudes of School Teachers, Principals and Students towards CAI

Most educational practitioners do not relish the prospect of automation because the unknown world of educational innovations such as CAI tends to threaten their security. In addition, the serious lack of knowledge about what computers can and cannot do, results in little, no or negative contribution by school personnel's to the adoption of educational innovations, like CAI Heinich et al., (1996).

It is obvious that interest is something that gradually develops with acquaintance. For example, Goodlad, Toole and Tyler (1966) noted the experience from other fields such as military science and business to say, "...with growth in understanding and with an increasing knowledge of existing installations, the utilization of educational technologies in general increases rapidly." While teachers are naturally change resistant as far as their teaching approaches are considered (Nicholls, 1983; Kravas-Dukas, 1996), given the necessary training about the functioning of the machine they are expected to develop a sense of confidence and curiosity to use CAI, and the same is true with school principals.

In relation to the concept of traditionalism above, teachers normally deviate from practicing a number of instructional innovations. For example, language teachers usually stick themselves to the use of the traditional grammar method than the modern communicative approach of teaching (Freeman and Richards, 1993). In explaining the root of such problems, Kravas-Dukas (1996) argues that attitudes of teachers, which are the outcomes of well-established old ways of doing things, make it difficult to fully accept and implement new ways of accomplishing tasks.

On the other hand, from what teaching experience witnesses teaching is a profession that has a lot to do with interests, feelings and emotions. According to (Burns, 1990), teachers' educational

attitudes and theories have a significant effect on their classroom behavior, influence what students actually learn, and are major determinant of teachers' teaching styles. In verifying this fact, Kennedy (1988) as cited in Kravas-Dukas (1996) pointed out that it is not enough for teachers to act in a certain way needed, they should also change the way they think about the new way of doing their task. In other words, Kennedy was meant, whereas doing something in a certain way needed could happen superficial, change in a way of thinking about a new way needed is an upright one.

This is not a mere debate old approach versus new ones. According to Wagner (1991) as cited in Philipston (1991), if incompatibilities in the philosophy of an approach and teachers' theories exist, teachers will tend to interpret new information in light of their own theories, and will tend to evaluate innovative ideas to conform with their old ways of doing things. Wagner's idea above some how coincides with what teachers of language teachers complain to say, "Teachers teach not the way they are taught to teach but the way their teachers taught them during their school days."

Therefore, if one is to effectively employ CAI, she/he need first strive for a favorable attitude among teachers, principals and even among students about the instructional program.

2.4.2. Organizational Atmosphere Required

Certain factors in educational institutions determine the extent to which innovation is carried out successfully. According to Nicholls (1983), four important conditions to be fulfilled in fostering educational innovations in schools in general include: organizational arrangement, school climate, organizational health, and organizational communication. These are discussed as follows.

Organizational Arrangement

Organizational arrangements that can influence innovations may include timetabling, rooming, and examination arrangements, etc, or major and fundamental ones, for instance, delegation of responsibility and channels of communication.

School Climate

This includes such points as pupil's attitudes to each other, relationship among staff and between staff and students, and attitude to work. For example, as Zenebe (1996) puts it openness and intimacy among teachers determines the general success of their school.

Organizational Health

This refers to the school system's ability not only to function effectively but also to develop and grow into a more fully functioning system (Clark 1969 in Nichols, 1983). For this scholar, such a condition includes reasonable goals, relatively distortion-free communication. They also include relatively equitable distribution of influences between subordinate and boss. More on this little feeling of strain among workers, members' feeling of being attracted to be part of the organization, are necessary. A summated set of individuals sentiments centering around feelings of well being and satisfaction, capable of growing, developing and changing, to have a kind of independence on setting one's own goals, the ability to cope with change, and manners in which to cope with problems are also important.

Organizational Communication

This refers to a condition in the organization that permits people to be heard as well as to be conversed.

In sum, while the above points revolve around conditions that facilitate innovativeness in schools, teachers and principals may not fulfill these by their own. Students, parents and other educational organizations need play their own active roles in facilitating for successful implementation of almost all educational innovations including CAI.

2.4.3. Material Resources Required

Materials for CAI use in schools in general can be categorized as hardware and software.

Hardware

The hardware aspect includes at least a building that can function as a computer center or lab and a number of other utensils such as Pc's, screens for projection, printers and scanners.

Of all the above, however, PC's are the basic ones. A point here, nevertheless, is how many PC's are appropriate for use in a class of a given number of students? Obviously, it would be much desirable if individual students work on specific software of their own choice sitting at a PC.

On the other hand, the ideas of providing individual or even small group students of most Ethiopian primary schools with PC's appears really unthinkable at least for the coming few years. Yet, this should not mean that Ethiopian educators have to give up all efforts. From the early experience of the rest of the world, the one-computer-classroom can form a good alternative. In describing such a classroom, Heinich et al. (1993:237) wrote the following.

... It is possible for a teacher to use a single computer with a whole class of students in creative ways.... The one computer classroom then can be viewed as a place where the computer is used in such many ways as large groups, small groups, lecture tool, learning center and personal secretary.

In case of large group, a large-screen projection is used to demonstrate to a whole class how to use a particular software program or how to manage a particular set of data. In the case of small group, a small group of student can work with a program in groups, then return to their seats, allowing others to have some time on the computer. Each group will have a turn in using the software to collect or present data. As a lecture tool, Wallington (1994) suggested that teachers could prepare a presentation with the day's lesson and then use the computer as a large projected blackboard. As a learning center having a core computer, through integrating a specific software program in to the center, the teacher creates another types of interactive learning center. At last, in using the PC as a personal secretary every teacher is responsible for maintaining grades, communicating with parents, and preparing instruction.

The computer, according to Heinich et al. (Ibid), does not only assist the teacher in the above ways. A computer kept in the school's library can be used for making information about resources both in and out of the school readily available for the present of future use. This will contribute more on information about resource materials to be bought.

In short, given teachers' knowledge, skills and positive attitudes about the use of CAI, and creativity, even a single computer in a classroom and one other in the school library can serve a wide range of purposes ranging from maintaining and storing information to providing instructional activities such as skills and practices.

Software

It is good to get teachers be designers of their computer-assisted-instructional programs for ubiquitous pedagogical reasons. However, designing a quality instructional software is no simple a task and in most cases it remains a co-operative effort of an instructional designer, a computer programmer and a computer scientist (Knirt and Gustafson, 1984; Alemayehu, 1995; Girma, 1996; Ellison, 2001).

In technologically advanced countries such as USA Britain, and Canada there are different publishers of CAI programs.

Nevertheless, these instructional publications should not be used without a careful selection and evaluation. It is said that poor quality of educational software ends up in unnecessary waste of learners' time. At the same time, haphazard preparation of them might result in both physiological and moral damage of children. In these regard, common aspects of educational software's to be evaluated are given next. According to Desberg (1994), specific aspects of CAI that need evaluation include the nature of the content, design, ease of use, manageability, motivation and other technical features of the instructional program.

In a more or less similar manner, Alemayehu (1995) puts these aspects to be evaluated as content, pedagogy, operation and documentation of the instructional program. The following summary is developed based on the explanation that the two writers gave for each suggested aspects above.

Instructional content refers to the clarity of objectives, sequential and analytical presentation of contents, exercises that are in line with objectives, appropriate difficulty level, varieties of presentations using graphics, sounds beginning with local presentation of concepts. CAI programs should also be free of sexual and racial, etc stereotyping as well as current references,

which may lead to obsolescence. Further, there should exist clear directions. Instructional designs should be in a way that new information presented in context and related to previous information, feedback provided immediately, a pacing which is appropriate and which can be controlled, provisions of summaries and reviews, proper use of varieties of sense appeals and volume control of sounds.

Ease of use includes points that follow. Students should be able to use programs without anybody's help, possibilities of forward and backward moves on menu and provision of clear and useful manual. Program management, on the other hand, refers to possibilities for students to move freely through the program on progress, keeping accurate and useful records of responses, branching based on student's score, allowing for handling diversity of learners, provision of diagnostic (entry) level testing, and helpfulness for cooperative learning. Such instructional programs should hold learner attention, and should not be demeaning ones to learners. Programs should allow learner privacy by avoiding unnecessary noise, for instance. Technical aspect refers to the quality of screen design, avoidance of unnecessary delays like slow loading of graphics. A program of good quality should not easily crash.

Much relevant here is criteria for selecting appropriate educational software'. In this regard, several authors over the past have either revised many other already existing selection criteria to develop a more comprehensive tool or have developed an original criterion of their own. Of all these, the most relevant one to the purpose of this particular study are revised for use by the present writer. The lists of these contributors can be referred under the sub-section titled observation-coding sheet in the third chapter of this same paper.

To put it concisely, nations need prepare their youth to this information age. To this effect, they must infuse information technologies into every aspect of their educational provision. The infusion involves computer usage. This act of infusion in itself involves making electronic equipments available in the schools with rooms to lodge them. It also requires getting, administrators, and teachers computer literate. This helps to use and the technology in a way that facilitates the learning-teaching process

2.5 Why do We Need Evaluate Programs?

Evaluation studies, according to Best and Kahn (1993), describe the status of a phenomenon with added value judgments, in terms of effectiveness, program desirability, or social utility explanations of reasons or underlying causes, and may suggest or recommend a course of actions. Here an important question will be why do people need evaluate programs.

According to Stake (1983), people expect evaluation to accomplish different purposes, such as documenting events, recording student progress, detecting institutional vitality, placing the blame for trouble, assisting administrative decision making, facilitating corrective actions, and increasing our understanding of teaching and learning. With all these purposes of evaluation, however, it is generally accepted that evaluation should not take the form of condoning certain subjects that are under some type of responsibilities. In this regard, Stufflebeam (1983:117) remarked, "The most important purpose of program evaluation is not to prove but to improve."

This being the fact, it is only from what we experience that betterment of any sort can be achieved. At the same time, while a large part of peoples day to day experience is the result of

criticism (it includes both approvals and comments), it should be remembered that we can only get these through undergoing an evaluation process of certain educational or other practices.

2.6 Models for Evaluating Adoptions of Educational Innovations

Under this sub-section of the review, the following different models are briefly put. These include a model for evaluating educational innovations by Nichols (1983); a model for evaluating CAI by Ina Fourie in Ellison (2001); and an IT model developed by Bates (1995:35) as cited in Yared (2001).

Nichols' (1983) Model for Evaluating Educational Innovations

This model mainly focuses on how and when to evaluate given educational innovations as well as their aspects that are requiring the most attention.

Accordingly, evaluation in its true context is always a continuous phenomenon. It is related to all activities of planning, developing and implementing of a given innovation. Unless the aim of evaluation is only discarding the particular innovation under study, it is always important to begin it as early as even before the innovation was identified. In elaborating, this Nichols wrote to say:

Evaluation of this kind begins even before a particular innovation has been identified. It begins when judgments are being made about desirability, need and feasibility in relation to innovation.... a situation analysis in order to determine, among other things, whether the condition for likely success are present or if they could be established.... And in a wider view of evaluation suggested here there is a merging of situation analysis and evaluation, with evaluation being seen as continuous, multi-faceted and taking place over a broad front. (Nichols, 1983:79)

As regards what is to be evaluated, these are the four phases: preparation (situation analysis), planning, implementation and evaluation. Such an orderly attempt of assessing the process by separating them into their inherently separate activities is, however, difficult to do. They are very much interrelated and their activities overlap.

In brief, the four phases include the following points. During the preparation or situation analysis the whatness of the instructional technology, alternative technologies, and the appropriateness of the organizational arrangement as well as the environment or school climate will be under question in relation to available resource and desirability of the innovation.

During the planning stage the extent to which the instructional technology or approach is clearly communicated to all teachers, and whether or not the necessary support including in-service teacher trainings are given will be raised as important questions. This phase is also concerned with checking if the planning is detailed and clear including how it copes with the unexpected, for example problems that arise in the middle, the way they are resolved and users reaction during such cases.

The third stage, implementation involves more of program evaluation questions that investigate whether or not the program is working as intended. The final stage includes investigating the breadth and depth of the evaluation mechanism in use.

In sum, within the four-phase framework the desirability of the adoption of the innovation, the setting and the personnel, the introduction of the adoption of the innovation, the process of planning, the innovation in use and the evaluation mechanism employed itself have usually been included as major points.

Ina Fourie's (1994) Model for Evaluating CAI

This model had mainly the form that Nichols' model above includes in different wordings. It also provide long list of criteria under each of the four phases: needs assessment or situation analysis, planning or preparation, implementation, and evaluation. The long list of criteria that this person had given is summarized to form part of the rating scale items for the study

Bates' (1995) Model for Evaluating IT

A third model for evaluating adoption of an instructional approach here is an IT model developed by Bates (1995:35) as cited in Yared (2001). While this model was originally developed for examining the rapidly expanding number of technologies entering the area of distance learning, it can also have implication for regular face-to-face instruction. It had the following seven variables: access, cost, teaching-learning interactiveness, user friendliness, organizational issues, novelty and speed.

These points have already been either defined or discussed in the foregoing section of the paper. Nonetheless, the concept novelty deserves further explanation. It is newness, and according to adoption theorists for an innovation to be adopted, it should not be too noble to the degree that the adopters lack the technical base to adopt it.

Novelty effect related studies of IT uses recently have indicated that certain new interactive technologies are being used by educational institutions without adequate justification as to their relevance and appropriateness for the program they have been used (Holmberg, 1996; Manjulinka and Redy, 1996; Bates, 1995 all in Yared 2001:407).

This according to the above writers is the influence of funding organizations, which are referred to be keen in investing much more costly but spectacular technologies such as computer-controlled videodiscs or satellite voice and networks than very low-cost but highly effective

teaching medium, such as audiocassettes combined with print materials. Lastly, speed refers to the degree to which courses need to be put on quickly and easily updated. It refers to the speed of implementation and flexibility in updating technology.

A Combined Model for Evaluating CAI

The present model combined the three models above for the purpose of this particular study. The original models include (a model for evaluating educational innovations by Nichols (1983); a model for evaluating CAI by Ina Fourie (1994) in Ellison (2001); and an IT model developed by Bates (1995) as cited in Yared (2001).

In bringing together all the relevant points to the issue under investigation there were also attempts made to enrich the present model by borrowing ideas from other sources too. For example, the present model had included an idea from Amare (1996). It is an idea of considering learners as important learning determinants.

Further, the model had attempted to incorporate important ideas from the works of earlier writers in the field of instructional technology who contributed by writing books or contributing journal articles. Their names could be referred to under the sub-section titled Observation Coding Sheet in the third chapter of this same paper.

Their points (criteria) include: situation analysis made, availability of resources, desirability of the innovation, teacher training, mechanisms for dealing with the unexpected, progress based on the plan, and evaluation mechanisms under use. The last two points in turn use a longer list of criteria under seven categories for assessing the quality of CAI program. Diagrammatically this model can be represented as shown under the design section of this study.

The variables below are identified based on the above model and encompass the four major points in teaching models. Instructional models, according to Arends (1997), refer to a particular approach to instruction that includes its goals, syntax, environment and management system. Syntax refers to the sequence of steps that lessons usually follow and environment refers to the nature of learning environment.

These variables can be seen under two categories. Of these two groups, the broader one includes points such as: facilities, organizational atmosphere, and attitudes of students and teachers.

The second group includes specific variables under seven categories. They all refer to the quality of CAI program. They include: knowledge (cognitive aspect), CAI program content, CAI instructional design, and ease of program use, program management, motivation, and technical aspects.

Accordingly, knowledge aspects refer to all the knowledge, attitudes and skills that make a given instruction comprehensive in principle.

Program content refers to the nature of the instructional content including clarity of objectives and the educational significance of the body of knowledge included. It refers to the instructional content appropriateness, its relevance, and the logical organization that it follows. It checks if the lesson relates to real life situation of the students, if activities fit objectives and whether or not multicultural aspect, such as exclusion of sex and sexual stereotypes have been attained in it.

CAI design refers to the effective usage of various forms of instructional approaches, such as drill and practice, tutorials, simulations, games and demonstrations. It also refers to the presentation of new information based on the previous ones, appropriate provision of feedback, the possibility of

controlling the sequence and level of difficulty of program contents, the availability of summaries and reviews and the existence of varieties of displays: sound, color and appropriate response.

Ease of program use refers to such points as learner's opportunities of moving through programs that are contingent on progress. It refers to the possibility of keeping accurate and useful records of responses of learners when using the particular software. It also checks whether the quality of the program permits branching based on learners' scores or not. It emphasizes on the programs capability to handle a wide variety of responses, to provide diagnostic entry level testing, and to allow effective, co-operative learning rather than competition.

Motivation refers to whether or not program holds attention-keeping students on task. It refers to the quality of the program not to demean or insult students. Still it refers to the quality of reserving students activities (e.g. no loud noise), and its quality of making learning fun or intrinsically motivating.

Technical aspects refer to whether or not screen displays are effective; programs are free of unnecessary delays; such as slow loading of graphics, and program does not crash easily.

2.7. Who Should Evaluate Educational Innovations?

Opposed to the usual practice of getting teachers who are involved in adoptions of given innovations under progress, educators such as Rogers and Gerald (1964); NAE in Ellison (2001) suggest the use of external evaluator or consultant, teachers who are not involved in the innovation activities or a teacher having some related expertise. The point of argument is to best balance the quest for objectivity on the one hand and for detailed knowledge about the real

progress of the ongoing innovation on the other hand. Accordingly, Nicholls (1983:84) commented the following:

An arrangement that brings the advantages of the alternatives mentioned and that emanates the disadvantages is one in which the tasks associated with the evaluation are shared between those who are involved in the innovation and colleagues who are not. The arrangement would work best if the group were to include at least one expert in evaluation, whether this was a member of staff or an external consultant. A consultant would probably be more acceptable to teachers if he were one of a group that had a shared responsibility, rather than if he were acting in more dominant role as in the first alternative suggested (which is bringing an external consultant who is expert in evaluation).

When explaining the details about how the evaluation should progress Nichols (Ibid) suggested the following. The identification of evidence and ways of collecting it would be a joint exercise between those who were involved in the innovation and those who were not. At this stage the involvement of an assessment expert would be of great advantage. The actual collection of evidence would be undertaken by the teachers directly involved with the innovation. Judging the evidence and proposing appropriate action would be taken by those involved. At this point Rogers and Gerald (Ibid) noted that the external assessor could be the researcher her/himself.

It is also the belief of the writer of this paper that objective decisions can only be made by independent bodies that are well informed. Therefore, this study to a possible degree follows the aforementioned way of making the evaluation a group effort.

2.8. The Place of Instructional Technology in the NETP

Countries who want to undergo reforms of any type usually prepare a policy in support of the desired change. A good example here is Japan. It is a measure taken to prepare her society for the information age. Japan ministry of education responded by issuing implementation guidelines for

normalization in the field of education, science culture and sport, which provide guidelines for the provision of advanced information and communication networks and satellite communications, the development of teaching methods and software to exploit these, and the training of teachers to contribute to the development effort (Sakamoto, 2002). In this regard when we examine the educational technology orientation of Ethiopian government we get the following in the (NETP 1994: 27-29) under its sub topic-educational support inputs:

In order to promote quality, relevance and expansion of education, due attention will be given to supply, distribution and utilization of educational materials, educational technology and facilities.... Due attention will be given to popular participation, in the production, distribution, utilization, upkeep, care and safety of educational materials, educational technology and facilities. The participation of various organizations and individuals will be enhanced in the production, supply and distribution of educational support inputs.

The above measure of the NETP appears timely because it is much in line with the modern learner-centered approach of learning-teaching. According to Wakshum (2001:27), the student-centered instructional approach is primarily supported by the application of instructional technology, which is supposed to be one of the main components of the approach. Here it should not be forgotten that CAI is one among the latest instructional technologies, and in fact according to (Sampath et al 1984) it is the most sophisticated and exciting type of all instructional innovations.

It appears cognizant of this fact that Ethiopian Government has already mounted on adopting different instructional technologies such as education through the medium of TV via Satellite and secondary school computer laboratories that are networked with WWW (EMA, 2003). However, educational innovations of most kind tend to be full of uncertainty at the initial period (Berhanu,

2001). In this connection, although it is still open to local studies of effectiveness and feasibility just like the ICT, CAI is an alternative technology in the field of instruction.

Finally, the writer of this paper believes that the question in relation to the adoption of innovations including CAI should not be a blind guess whether Ethiopia can adopt or not. It should be a question of the presence and absence of genuine efforts in the area. In her argument that verifies this idea, Betsate (2000:5) wrote on issues of media utilization to say the following.

... The problem is not just a matter of implementation. More importantly, it is a problem of planning too. For instance, the educational planners in ... have mentioned only vaguely about non-textbook instructional materials in the five-years ESDP...

The essence of the above finding by Betsate is then educational planners play a key role in taking the initiative in adopting educational innovations such as the use of new instructional technologies. In general, the NETP has emphasized on the use of instructional technologies as important inputs to improve the quality of instructional provision in the upper secondary grade schools.

CHAPTER THREE

3. METHODOLOGY AND DESIGN OF THE STUDY

In this section the methodology, subjects, sampling techniques, instruments of data gathering, pilot testing, and methods of data analyses employed in the studies were treated.

3.1 Methodology of the Study

This qualitative and quantitative descriptive survey attempts to investigate the endeavors of using computers for supplementing instruction in our non-government primary schools vis-à-vis problems encountered in using the instructional technology. The study approached the issue from different perspectives through combining the ideas in different conceptual models that were made available by earlier writers and researchers in the field of instructional technology.

It considers the evaluation mainly to take the form given by Nicholls (1983); and Fourie (1994), the latter cited in Ellison (2001). According to Nicholls, the specific tasks underlying each of the four phases of evaluating certain instructional innovation should be done from three angles: educators who are involved in adopting the innovation, educators who are not involved in adopting the innovation and an external evaluator who could (according to Rogers and Gerald) be the researcher himself. At this point students as important learning determinants, Amare (1998) calls them, can form a fourth perspective from which the instructional practice need undergo evaluation. The study also used an IT model originally prepared by Bates (1995) as cited in Yared (2001). It refers to issues, such as organizational atmosphere, access, teaching-learning interactivity, user friendliness, novelty and speed.

Just by putting together the relevant points from the four models above, the writer adapted earlier models for evaluating CAI as one form of instructional technology.

Thus, the present model attempts to evaluate the instructional technology from four perspectives: learners, teachers who use CAI, teachers who do not use CAI, and an external evaluator. The latter three groups of evaluators assess the quality and quantity of the details under each of the four phases: preparation or situation analysis, planning, implementation, and evaluation.

Diagrammatically this model can be shown as follows.

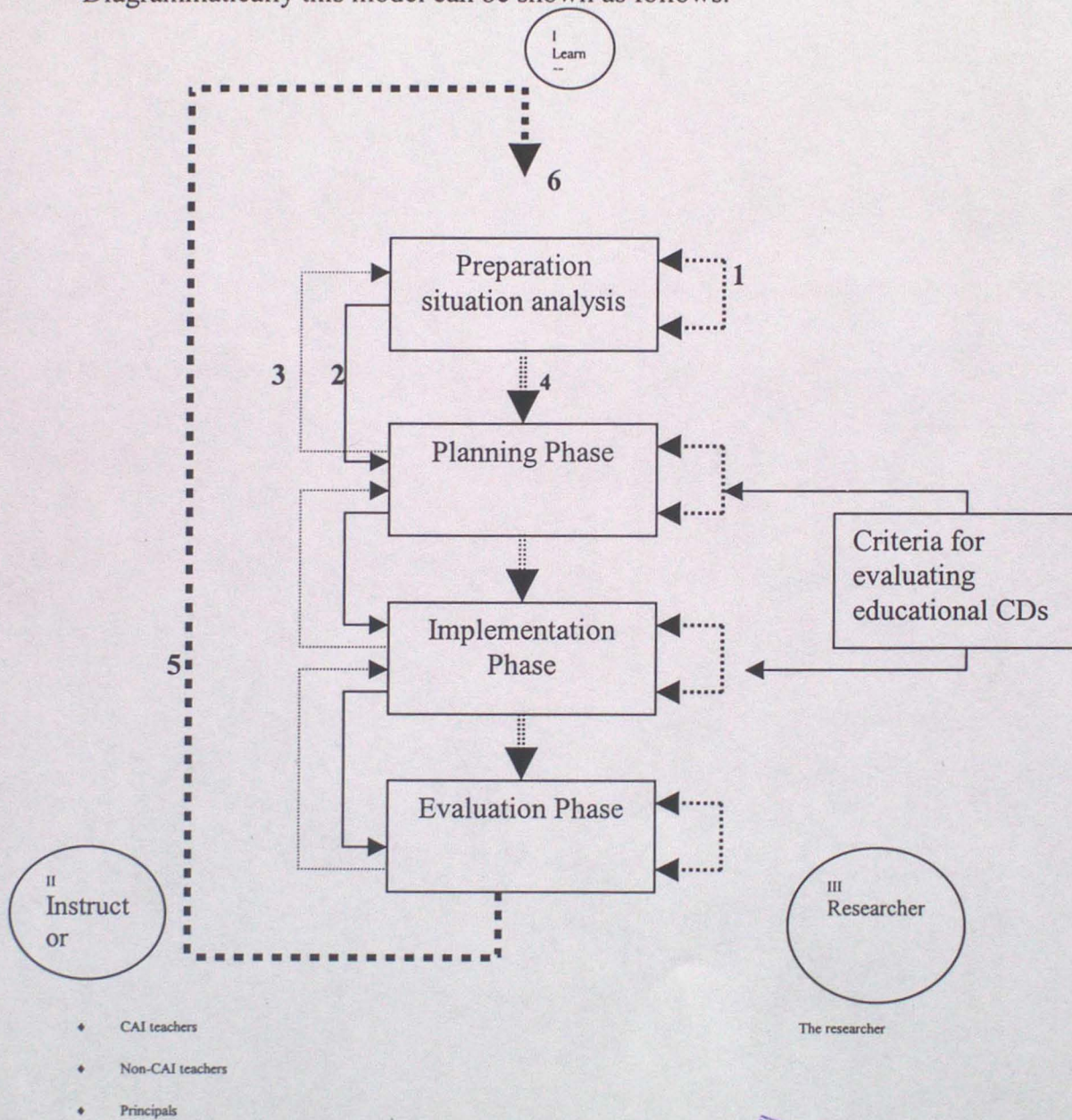


Fig.2 A Conceptual Framework for Evaluating CAI Program.

1. Points to consider within each phase
2. Initial move from one phase to the next
3. Feedback from one phase to a preceding
4. A move based on feedback from preceding phase
5. Overall feedback
6. A re-preparation phase based on overall feedback

The model also includes several variables that were defined under two categories that are referred to under sub-section 2.7 of the literature review.

3.2. Subjects of the Study

The on-going instructional programs in three primary schools in Addis Ababa and one school in Awassa, students, teachers and principals there formed the subjects of this study. The primary schools are namely: Supper Holy Savior, Sanford International, German Church, and SOS Herman Gemainer.

3.3 Sampling of Subjects

The subject primary schools in the two towns are chosen on availability basis. Classroom lessons that are offered by those teachers who claim to use CAI were chosen for observation using same sampling technique. The observers were CAI teachers, non-CAI teachers and the researcher as an external evaluator. This is done purposely to examine the point from different perspectives. Eight students were chosen from each of the four schools following the recommendation of the CAI teachers as to which of the students are having better experience of computer use in the school. These students sum up thirty-two.

All the principals in the subject schools and teachers that have the experience of using CAI and equal number of teachers who do not have the experience were interviewed. This is because this mixing of the above groups is favored for assessing educational innovations for the sake of both detailed information and objectivity (Nicholls, 1983).

In brief, the sample informants listed in the table below include four principals, thirty-two students in four groups, and thirty schoolteachers.

Table 1: Number of Sample Respondents in their types

Primary School Name	No. Of Teachers		No. Of Principals	No. Of Students
	CAI	Non-CAI		
S upper Holy Savior	3	3	1	8
Sanford International	6	6	1	8
German Church School	3	3	1	8
SOS Herman Gmeiner	4	4	1	8

Note that the researcher as an informant of this study provides his critical reflections from both the in-depth interviews and by filling the rating sheets that are equal in number with those teachers who were observed while teaching using and who at the same time were made to fill the rating themselves. In other words, the rating scale was filled by 45 people during the 15 classroom instruction observations by the three groups of people.

3.4. Instruments of Data Gathering

The data gathering instruments used were interviews and observation coding sheet.

3.4.1. The Interviews

The interviews are prepared for teachers, principals, and students. The items are developed based on the four phases of evaluating educational innovations given by Nichols (1983). The original evaluation framework by him had about 75 specified questions under the sub phases: desirability of innovation, the innovation, the setting and personnel, introducing the innovation, process of planning, the innovation in use, and evaluation. These four different interviews are all attached. See Appendix B, C, D and E.

3.4.2. The Observation Coding sheet

The observation-coding sheet is used to assess the overall progress, the volume and quality of the instructional provision during a three- round classroom observation in each sample classroom.

The checklist attached in appendix A is adapted from earlier works of writers such as: Witch and Schuller (1979); Allen, Gerlach and Ely (1980) in Knirt (1986); Dede (1989:14); Burns, Goin and Donald, (1990:80); Charles and Hubbard (1992:91-93); Desberg, (1994: 345-354); Alemayehu, (1995) in Girma (1996:36-38); Heinich et al. (1996:277, 317,335); Shades, (1996:78); and Ellison 2001:1-3).

3.5. Pilot Study

The various interviews and the rating scale for classroom observation are pilot tested in the town of Awassa. This is because the researcher found the required facilities and volunteer educated work force there.

3.5.1. The Interview

The interviews with teachers and principals as well as the focus group discussion questions were pilot tested on this same subject teacher, students and principals of SOS primary school in Awassa. Thus, the interview items were accepted for actual use with some amendment or rejection in case of serious defect.

3.5.2 The Rating Scale

Under this sub-section determining inter-observer agreement, selecting appropriate items, and testing scale reliability are treated.

Determining Inter-Observer Agreement

The test for the inter-coders' agreement was done on a sample lesson. The researcher and his colleague did the rating and the result was a .90 agreement. This is an interesting level indication of consistency as Knupfer and Mclellan (1996) put 70 to 90 per cent agreement to be usually considered satisfactory when observers must make inferences or evaluations about the behavior being observed.

Selecting Appropriate Items

The points to be checked covered major aspects of CAI: knowledge aspects included, program content, instructional design, ease of use, program management, motivation, and technical aspects. From over a hundred of items for checking qualities of instructional programs that are

suggested by different scholars, the writer chose forty-four of them on their face and content validity.

The items are placed in to seven categories that were more or less common to all the original developers of the criteria. Next to this items was a grid consisting of five columns indicating levels of agreements: strongly agree (5), agree (4), undecided (3), disagree (2), and strongly disagree (1) respectively. Respondents are asked to encircle the appropriate number to indicate how much they agreed or disagree with each item in evaluating CAI lesson arranged for this purpose. Thus, the highest and the lowest score imply an excellent quality and the lowest score imply the poorest quality program.

In determining the items that are most representative and successful in rating the quality of CAI, an item analysis was carried out. This was done as follows. Just before the class was held, the researcher arranged an open discussion with forty graduating class (year 2) students in Awassa TTC. This discussion on the observation coding sheet and its items was noted to have made things all clear for these evaluators.

Then, the forty-four items were given to these forty co-operative trainees and they rated a CAI lesson arranged for the purpose of this pilot test. A teacher and ten volunteer primary students of SOS school made up the pilot class. Regarding the effort to minimize the placebo effect, the evaluators and the subject classroom students were allowed to have a short formal discussion on self-introduction to someone sitting by their side for 15 minutes. Finally, a forty-minute lesson was held and the evaluators submitted their ratings for a thorough analysis by the researcher.

Doing this helped in determining which items have the highest correlations by correlating the respondents' score on each item with her/his total score minus the score for the item in question.

On the response of these respondents, an item analysis was carried out and the correlations were computed. While items with relatively stronger correlations ($r > .30$) were directly taken, those with less correlation coefficient were improved and only two of them were rejected. The forty-two items fell in to each of the seven previously mentioned thematic groups as follows.

1. Knowledge aspects included (6 statements)
2. Program content (11 statements)
3. Instructional design (6 statements)
4. Ease of use (5 statements)
5. Program management (6 statements)
6. Motivation (5 statements)
7. Technical aspect (3 statements)

Testing the Scale for Reliability

The rating scale was also distributed to another group of forty, year two trainees of Awassa TTC. The trainees rated a class arranged for same purpose. All the forty rating scales were collected and the Cronbach's coefficient .99 was obtained. This proved that the scale had near to perfect consistency. On the other hand, it has been reviewed in literature that most rating scales achieve a reliability coefficient of .85 Kravas-Doukas, 1996; and Willson and Cole, 1996). It is the belief of the researcher that the scale achieved a very good consistency in that the level of face validation made was so robust. After this reliability check, and the discussion of the researcher with his colleague, it was decided that the forty-two items would constitute the final version of the scale. See appendix A.

3.6. Method of Data Analysis

This evaluative study has employed a qualitative and quantitative descriptive survey. Writers in the field of educational research favor the use of the two approaches in combination for both in-depth and objective investigation of issues under study (Gall, 1996; Corte, Vershaffel, and Lowyok, 1994). Quantitative data analysis in the form of weighted mean, median and variance were combined with opinions of teachers and the researcher regarding the CAI progress in the subject schools. This combination of quantitative and qualitative approach had recently come to be common in investigating educational technologies (Leedey, 1987; Wiegmann, 1996 in Savenye and Robinson, 1996).

The purely qualitative description was used to analyze data, such as the researcher notes from focus group discussions with students, and data from the semi-structured as well as open-ended interviews with teachers and principals. Accordingly, the study followed an analytical approach of describing, interpreting, evaluating or appraising. Such matrix analysis was chosen for this study because it was suggested to be an important strategy for reducing a large amount of qualitative raw data in to a better manageable size for discussion (Goetz and Lecompte, 1994 in Savenye 1994; and Averill 2002).

Here the researcher used his own critical reflection and thematic and matrix analysis. A matrix is defined as a set of numbers or terms arranged in rows and columns that within which, or within and from which, something originates, takes from or develops (Agnes, 2000 as cited in Averill, 2002). The descriptive matrix in this study is used to display categorized data in individual cells, just to observe what appears.

The quantitative technique was applied on data obtained from teachers using a five point rating scale. Each teacher and the researcher observed a given class for three periods. The first day the

researcher or the teacher observer only made themselves available in the class, albeit they carefully watched what was going on in the class. This helped them to neutralize the observer effect on the reliability of the collected responses. During the second observation, the same observers did the rating based on the orientation. At the end of the period the observers read the rating carefully and discussions were held with the researcher on points that need clarification.

The classroom teacher did the same immediately after the lesson was over. During the third and last observation, both groups of teachers would finish their rating and submit it to the researcher.

On the other hand, the researcher himself did three consecutive observations of sample classrooms chosen on a purposive basis.

In testing the statistical significance of the differences among the mean scores of CAI teachers, the non-CAI teachers as well as the researcher on each category of the scale, the F test was used with a chosen α level of 0.05. The use of this α level is quiet common in educational research. The F test is chosen because analysis of variance (ANOVA) is supposed to be an effective way to determine whether the means of more than two samples are too different to attribute the variation to sampling error alone (Norusis (1997;Best and Kahn (1999)).

The above writers put some preconditions to be met for the F test to be used. They also comment that for one-way ANOVA it is possible to violate some of the preconditions given the variance are showing equality. Thus in addition to his attempt of making the observations independent, the writer had checked for the equality of the variances obtained among each of the three group means for each scale category.

The Tukey Test was used to probe into the differences among the three group means.

CHAPTER FOUR

4. PRESENTATIONS AND ANALYSIS OF THE DATA

This part of the paper treats presentation and analysis of the data gathered from students, teachers and principals of Addis Ababa and Awassa non-government primary schools that use computers for supplementing their instructional offerings. In addition, a number of teachers in these same school who are not involved in using CAI and the researcher as an external evaluator have rated CAI programs.

4.1 General Information on Respondents

Table 2. Student Respondents by Age and Grade Level for the Focus-Group Discussion

School name	Grade level	Age group	Group size
Super Holy Savior	8	13-15	8
Sanford International	5	10-12	8
	6	11-13	
German Church Sc.	8	13-15	8
SOS Herman G. Sc.	5	10-12	8

As could be noted in the above table the students are found in two age groups. The year five students in Sanford International School and grade five students in SOS Herman Gmeiner School are found in their late childhood period. Children in grade eight in Super Holy Savior and in German Church School, and those in year six in Sanford International School are found in their late childhood period and above.

According to the objective reality of the student's access to computers and educational CDs in their school, the researcher believes that they can all be grouped into a more or less similar category for the ongoing analysis.

Table 3. Teacher Respondents by their type of computer skill training, years of service as a teacher, subject to teach and teaching load

School Name	CAI Teachers				NON-CAI Teachers			
	Computer literacy	Years of service	Subject to teach	Teaching load	Computer literacy	Years of service	Subject to teach	Teaching load
Super Holy Savior	Ms.C.P.	4	Chemistry	24	Self Training on basics	4	English	26
	Ms.C.P.	2	Biology	26	Self	3	Physics	29
	Ms.C.P.	6	Biology	27	Self	5	Maths	28
Sanford International	Ms.C.P.	8	General	35	Self	18	General	30
	Ms. C. P. + IT Diploma	6	General	27	Self	10	General	28
	Ms.C.P.	4	General	33	Self	17	General	31
	Ms.C.P.	15	General	31	Self	13	General	33
	Ms.C.P.	8	General	30	Self	14	General	35
	Ms.C.P. +IT Post Graduate Diploma	8	IT	36	Self	16	General	30
German Church	Ms.C.P.	11	Physics	25	None	11	English	24
	Ms.C.P.	11	Maths	24	None	10	So. St.	25
	Ms.C.P.	9	Biology	26	Self	13	Chemistry	26
SOS Herman Gmeiner	Ms.C.P.	4	Chemistry	30	None	5	So, St.	27
	Ms.C.P.	4	English	28	Self	4	Maths	29
	Computer Sciences Diploma	2	IT	28	Self	5	Physics	28'

As indicated in the design section of this paper in chapter three equal number of teachers that use CAI and those who do not use are involved in the study. Accordingly the six schoolteachers in the first, twelve in the second, six in the third, and six others in the fourth school added up thirty. As could again be read from the above table four of them teach English language, and one teaches social studies. Ten of them teach natural sciences and another three mathematics. They

have years of services ranging from two up to over fifteen. As for their type of training or education in relation to computer use, most of them have basic computer skills at least after self-training. One had a postgraduate diploma in information technology and one other had a diploma in the same field. Two others had computer science courses in their college days.

Table 4. The school Principals by their Qualification, Experience of Computer Use, Years of Service as a Teacher and Subject to Teach

School Code	Graduated in		Subject to teach	Computer literacy
	Major	Minor		
A	Physics	math	Chemistry	Ms.C.P.
B	Disaster management	-	-	Self-trained
C	Social science	-	-	Self-trained
D	English	History	General	Ms.C.P.

As indicated above the school principals have different educational backgrounds and some have participation in the instructional activities directly. Two of them had a computer skill training by trainers and the other two trained by their own.

4.2 Presentation and Analysis of the Response Obtained from Interviews

In this section the researcher used his critical reflection and thematic and matrix analysis. The data-planning matrix below was used to display the research questions along the row headings, with a set of equivalent questions along the column headings.

Table 5. Response from principals

Research question	Evaluation questions		
<p>Have the non-government Schools under reference Carried out situation analysis and proper planning before they began employing computers for instructional purpose?</p>	<p>What procedures did your School follow in bringing Computers to classroom use?</p> <ul style="list-style-type: none"> • Followed foreign school visits by the headmasters • Shared experience from foreign consultants • Response to questions from parents • Foreign aid made the machine available 	<p>What related facilities do you have for CAI use in your school?</p> <ul style="list-style-type: none"> • A computer lab • Seven computers • About 76 CDs • Two computer labs • A computer in each room • A computer lab in learning support • An IT room with about 30 computers • About 56 CDs 	<p>What levels of training do your teaching staffs have in relation to computer use?</p> <ul style="list-style-type: none"> • Most are Microsoft certified partners • Mostly we hire computer literate teachers • We have an IT teacher • We have an electrical engineer as a resource person • We have a teacher who had the skill and knowledge of computer science • Some of our teachers have got the skill • We have an IT teacher who had studied computer science
<p>Researchers commentary</p>	<p>The schools appear to have brought computers in to their offices for word processing and then gradually developed the interest of using them for IT training and for CAI.</p>	<p>In some of the schools, the primary grades use a computer lab with the secondary students. In one of the schools, three computer rooms are available. The educational CDs available in each school differ in both number and type.</p>	<p>In one of the schools, there were repeated attempts of training teachers for basic skills. Some of the schools have enough skilled people. Some of the schools appear to have a few skilled staff.</p>

As could be realized from the table above the subject schools carried out no need assessment. They simply made use of computers for teaching basic skills or for supplementing the classroom instructions when they got the machine from foreign aid or by buying themselves. Some of the schools entered into the use of computers for classroom purposes following their fear that parents

might not send their children to their institutions unless the schools carry out the big task of introducing the children with the timely technology. In some other case the headmasters of the schools brought the experience from their school visits in the overseas or after they received a consultation service from their regional head offices in neighboring African countries. In a uniform pattern, the schools used computers for office work and gradually used them for classroom purposes. This is quiet natural in the realm of accepting change.

There is a considerable gap among the four subject schools in their related facilities. Some have a one-computer classroom. These computers were reported to have been effectively under use by some teachers who use them with screen projectors and the like. However, the researcher practically observed the single computers in the classrooms mainly serving teachers as simple word processors and as source of information. The researcher observed at least a computer lab in each of the four schools. The size of these rooms and the number of computers that are made available are nevertheless incomparable.

For example in the fourth school, which of course had the least and not as such satisfactory facilities, there is a small computer room in poor condition with about only 5 computers found in it. A computer-science diploma graduate assigned to carryon the whole responsibility of maintaining a smooth running of computer use for classroom purposes. In the second school the one computer- classroom are accompanied by a computer center, two computer rooms and an IT room. The IT room having about 25 computers serves as the main center to run aCAI lessons. In a computer-room adjacent to it with about 9 computers is reserved for learners' additional interest of search and for desktop publishing. Still in a room adjacent to this is a computer lab where the resource person (i.e. an electrical engineer) is found working on a main server computer for the smooth running of lessons on computers. In another computer room in a learner support

department, there are about 8 computers available for helping students that require special educational support.

In this second school, almost all of the teachers had at least self-training of basic computer skills. Of course, all the CAI teachers in the four schools identified themselves as Microsoft certified partners, albeit the researcher did not go as far as checking this formally. On this point except three teachers in two of the schools who had little or no training in relation to computer use, all the other 12 non-CAI teachers identify themselves as having self-training of basic computer skills. In the first school, again, there is a well-trained resource person who can at least in part replace a software engineer and a well trained IT teacher.

Among facilities for proper CAI programs are the educational software. In the second school, it is said that their collections of CDs are procured by subscribing them through the Internet having taken their addresses from the Internet itself or other sources. In the rest three schools, the trend appears to get CDs brought to schools during the occasional visit that the headmasters pay to foreign countries.

As for the type and number of the available educational CDs, the following has been noted by the writer. The first school had been quoted to have over 76 CDs. The writer had in fact could see several GSCE CDs and a few school ROM CDs. These are mostly on language and natural science subjects like biology, chemistry and physics. In the second school are found a very large number of these, say over 100 mixed in content and level of education. There the researcher had identified over 56 CD ROMs for primary school children in areas like world history, basic arithmetic, biology and SAT (test base).

In the third school about 10, computers had been arranged for students in a small but neat computer room, which was very recently arranged. There a person who had training in a related field (i.e. analectic engineer) was found serving the students as an IT teacher and as a resource person too. In this school in addition to the few available CDs, in general science and language there are a few others in basic arithmetic's, social and natural sciences.

In the last school, about 40-45 educational CDs were reported to be available in the resource center of the school. Of these 20 were said to be for language, 15 for science and 5-10 for mathematics. The researcher had the chance of examining most of the CDs in their computer labs and in the class during his observation. He had noted at least some interesting instructional approaches. To mention some by their labels:

- ◆ The Ultimate Human Body. Copy Right 1995
- ◆ Eyewitness History of the World 2.0
- ◆ The Worlds Weather
- ◆ The Planets; The Ultimate Astronomy CD ROM Copy Right1991
- ◆ Journey through the Human Body
- ◆ Essential History (Second Edition)
- ◆ Cartopedia A-Z (social studies Encyclopedia)
- ◆ My first Amazing World Explorer Copy Right 1996
- ◆ SAT (Standardized Achievement Tests)
- ◆ GCSE (Graduate Certificate of Secondary Education)

The researcher's comment on these CDs is that they are of great quality in drawing learners' attention, albeit some appear difficult and others lack relevance with the Ethiopian context. Their use has been noted as not as such difficult and the procedures to follow have commonly been found with very handy pieces of publications that are found with the CDs themselves. As you

look at a few of them next, you will check if that poses a problem to teachers even with little computer skill training.

How to Get Started

- Insert the disk in the CD ROM Drive
- The set up program should start automatically. If it does not, press Ctrl + Esc, then R, and go to step three.
- In the command line box, type d:\set up (where d is the letter of your CD ROM drive), then click OK or press Enter.
- Follow the instructions that appear in your screen.
- The set up program creates a program icon in an OK Interactive learning program group, For instance.
- Double click on the icon to start the program
- If you experience any problems, double click on the READ ME icon.

In Apple Mc Intosh

- Insert the disc
- Double click on the product icon
- If problem, click on the READ ME icon

To Install the CD

- Click Drive in my Computer
- Click pc
- Click Install
- Click OK

To get Started

- Click start button
- Click program

When you unteie the menu bar at the end, you will get certain icon, say it could be the e picture of an umbrella

- Double click this icon

Table 6 Responses from Teachers

Research question	Evaluative question			
How much and how well are computers in use for supplementing the regular lessons in these schools?	<p>For what different purposes are computers in use in your school?</p> <ul style="list-style-type: none"> • For teaching basic computer skill • For writing students tests • For searching information in the Inter-net • For various educational entertainment games • For playing related educational CDs • For printing beautiful headings for their portfolios • For helping students with disabilities 	<p>How frequently do you use CAI?</p> <ul style="list-style-type: none"> • Whenever topics and available CDs match • Twice a week during the it PERIOD • When topics call for the need • Rarely as teachers are busy with our day-to- day routines 	<p>What is your overall evaluation of CAI provision in your school?</p> <ul style="list-style-type: none"> • Very encouraging • Makes students confident • It did not function, as it should in other countries due too low investment on it. • It is an issue that deserves consideration as it simplifies tasks. 	<p>What progress did CAI provisions bring on your students?</p> <ul style="list-style-type: none"> • Motivation • Clarity and neatness of communicating students tests and etc. • Quick understanding of concepts on the part of students • Increased consumption of IT for study purpose.
Researchers commentaries	<p>The computers serve more as a computer skill lesson tools. Of course, there are attempts of using them for various games, access to information and tutorials.</p>	<p>Particularly in some of the schools students have rare chance of seeing computers. In some of the schools, there is a faire access to PCs but teachers are too busy.</p>	<p>CAI is seen as a timely approach but it requires investigating more on training teachers and arranging additional computer rooms.</p>	<p>Students seem to have a high level of interest to their CAI lessons.</p>

The other important point in relation to CAI program qualities in the subject schools is the overall progress of the learning teaching process since the coming of computers in to classrooms.

As could be seen in the preceding table, the quality and volume of CAI program in the subject schools is under investigation here. To this effect the researcher had examined points such as the different purposes that computers are serving in the schools, the frequency at which computers

are under use for classroom purposes, the observed effects of using computers for classroom purposes as well as the overall evaluation of CAI programs in the subject schools will be discussed next.

Teaching basic computer skill is the common classroom activity that all the four schools offer to their students in what they call computer laboratory, computer room, or an IT room. Adjacent to this the schools use the computers to help their students in getting access to information in areas of learner interest as well as on teacher set reading assignments. In all the four schools, it is common to get a collection of educational CDs on various subject areas. Although these were not found in repeated use, as the CAI teachers themselves reported, to use such programs rarely, say in a fortnight, in a semester, the researcher managed to carry on observation on a kind co-operation of the teachers. Particularly in one of the school, which is of course the one supposed to have the better facilities, computers have been noted to serve as objects of entertainment to students in providing educational games especially for students having certain learning disabilities.

In two of the schools, again computers have been noted to help teachers for desktop publishing of impressive headings for students' classroom activities. In all of the schools, computers were seen to be good servants of teachers in writing and editing classroom tests and examinations. However, it has not been seen a case when teachers processing their students grades using computers. When questioned why that was the case teachers responses were simply not doing it. On this point the researchers comment is that the teachers had little impression in the advantages that the various programs, such as Microsoft access, and Excel can offer to a classroom teacher as an action researcher at least. Further, the researcher noted that the machines are serving more as an IT lesson tool than as supplements to the regular classroom teaching of subject areas.

However, it is worth appreciating the efforts of the schoolteachers in using the different educational software's within their reach.

The response obtained from the focus group discussion with students substantiates the same idea. Nevertheless, students in some of these schools had some doubt if they had ever experienced to use educational CDs in their lessons until the time the focus group discussion was held. Computers in use just directly for supplementing the subject- area classroom lessons are infrequent. The researchers commentary in relation to this point is CAI use in the schools are so infrequent that even some students in some of the schools had rare chance of working with the computer in the forty or so minutes period.

In responding to the question teachers unanimously reported that their students have shown a better state of motivation, increased consumption of information from the computer in programs, such as Encarta, and in most cases from the Internet. Others have noted their students to exhibit quick understanding of concepts and still other teachers consider their educational significance of communicating test questions with clarity. Teaches remarked that it will not be comparable with the usual chalkboard style in many ways. The researchers further comment at this point is that students showed high level of interest to their lessons in computer rooms. However, the writer has also some fear that the high levels of students' interest to their lessons in computer rooms in general were not consistent with the use of certain educational programs through computers. This has been noted by comparing the class-size of successive lessons.

The volume and quality of computer use in the four subject schools showed a considerable gap. In one of the school, which was supposed to have the best facility, there is a trend of using computers for a wide range of purposes. There are teachers who use the computers for teaching

special mathematics program, such as Megabyte Brain, social studies, and composition. Other teachers in this schools use the computer for sending their students to it for searching information on various topics. In this school, there is a well-organized -IT lesson for students.

The IT lesson in the second better school is also found under good progress. The educational CDs under use for classroom purpose in the latter three schools; however are not that much satisfactory. In deed in the eye of the researcher, the teachers had rare experience of using the educational CDs for classroom purposes, albeit they have carried on sample lessons in response to the observation need of the researcher. Particularly the Non-CIA teachers had many complaints over their inability of using the CDs for supplementing their classroom lessons. Lack of training, denial of access to the computers for the necessary use with students, a curriculum not matching the available educational CD topics, students varied level of knowledge and skills on computer use are among the common problems they forward.

As a whole, irrespective of the efforts by teachers to use CAI, the use of computers had been limited to the use of very elementary educational games and in fact for teaching basic computer knowledge and skills.

Table 7. Responses from principals and teach

Research question	Evaluative question What are the problems your schools faced in an attempt of using CAI?
What are the conditions that limited the use of computers in the subject schools to its actual state?	<ul style="list-style-type: none"> • Shortage of computers • Shortage of buildings or rooms • Cost of updating computers • Cost of repair services • Limited skill and computer use on the part of the teachers • Absence of CDs that much the local curriculum • Limited chance of teachers in ordering CDs that really be of good consumption • CDs locked with passwords • Shortage of proper training • Over sensitiveness of school authorities to computers • Teachers overindulgences in their daily routines • Repeated power interruption
Researcher commentaries	In some of the schools, there is a severe lack of skills in using the technology as well as lack of computers and appropriate buildings.

The next question forwarded to schoolteachers and principals or vices was "What are the problems your school faced in an attempt of using CAI?" In responding to this question, the commonest complaints included shortage of computers and buildings, cost of updating computers, and cost of repairing services. Further, insufficient training of teachers in computer use, and the over-sensitiveness of the school authorities in allowing computers for use by children as well as teachers were also reported. In addition to these, teachers overindulgences in their daily routines, absence of CDs that fit the local curriculum, limited chance of teachers in ordering workable CDs, CDs locked with passwords, and repeated power interruption were found to be common causes affecting the efforts.

Particularly in three of the schools, the rigid curriculum that the schools follow by itself had been noted to add to the problem of using CAI. Here the problem is that the topics in the available educational CDs little coincide with the contents of the syllabi. Of course, this had not as such been the case in the fourth school, where some- how different curricula are combined for use.

The researcher on the other hand have noted that very poor related facilities including limited training of teachers in relation to computer use, proportionally few number of computers to students in each class are common setbacks that CAI program is facing in the schools.

Table 8. Responses from principals and teachers

Research question	Evaluative question			
	How did your Schools manage Shortages of hardware's?	How did your school manage shortage of educational CDs?	How did your school manage teachers lack of knowledge and skills to use CAI?	How did your school manage updating and repairing cost of the machine?
How did the schools manage the limiting conditions from the full scale use of CAI?	<ul style="list-style-type: none"> Using the IT rooms of the upper grade students Admitting a limited number of students per class Dividing the class in to two smaller groups during CAI provisions 	<ul style="list-style-type: none"> Buy CDs by ordering them after looking for addresses in the electronic medias Getting CDs from friends and other connections Buying some following school visits of headmasters in other countries, usually USA and Britain 	<ul style="list-style-type: none"> Hiring teachers who are computer skilled Offering computer skill training for teachers in the school Arranging access to computers to get them experience it themselves. 	<ul style="list-style-type: none"> get technicians from out of the school hiring it experts and others having at least related trainings with soft and hard ware engineering
Researcher's commentaries	Dividing a class in to small groups just for CAI lessons and using the IT room of the upper graders is one alternative. This however might not be possible in all schools because some of the schools are having their secondary schools in far away locations. There might also problem of inconvenience in dividing students.	<ul style="list-style-type: none"> In almost all of the schools, the trend is buying educational CDs in bulk incidentally. 	<ul style="list-style-type: none"> Teachers in most of the cases do not appear to have sufficient skills to use CAI. The efforts of some of the schools in training their teachers failed for different reasons. 	<ul style="list-style-type: none"> Those schools that hired IT expert and person of at least related training to hardware and software engineering had good CAI provisions.

The other important question addressed to the respondents is that "How did your school manage the limiting conditions from full scale use of CAI?" First of all the respondents claimed that they admit only a reasonable number of students, say about 35-40. Dividing these students in to two smaller groups had also been considered and used by two of the schools, though the researcher had some suspicion on the inconvenience that doing so can create in primary schools of these types. The inconvenience here is that the approach makes the learners use only half of the period

they can have for CAI lessons in the academic duration. In relation to shortage of equipments, the school personnel also reported to have used IT rooms that are arranged for teaching their upper grade students. This wise and economic use of material resources had been observed in two of the schools.

In their attempt of solving scarcity of educational CDs, the school authorities noted that they order CDs through the Inter net, copy CDs that are available in their localities, procure them during their school visits in the Overseas. However, the researchers comment on this point is that in almost all the four schools the trend is buying educational CDs in bulk rarely.

In relation to the mechanism that the subject schools get their teachers computer literate, the schools have at least an IT teacher who had got minimum of computer science college diploma. One of the schools has been reported to have arranged a computer skill training program for its teachers though the efforts were corroborated at least partly doomed to failure simply because teachers are busy with their daily routines. Of course, some of the schools have relatively well skilled teachers.

These schools manage the repairing activities by hiring technicians from outside every time they needed help. This in the mind of the writer is among the major factors that call over sensitiveness of school authorities to computers to be left to teacher and pupil consumption. Of course, two of the schools have at least one engineer in a related field each, one an IT expert too.

One of these schools updates computers by buying new ones while using the old ones for other educational purposes. There had not been heard updating of computers with the rest three schools though one of these latter three has only recently brought the computers.

The writers comment on this point is that the schools having better qualified staff in relation to computer use, as well as at those having at least computer engineering related degrees maintained a smooth running of their CAI programs.

Table 9. Response from students and teachers on their reaction towards CAI use

Research question	Evaluative question	
	What do you students say about learning using computers?	What do you teachers say about attempts of using CAI in your school?
What is the reaction of students and teachers in the schools under reference to CAI?	<ul style="list-style-type: none"> • Computers make things brief • Computers have lots of new ideas and knowledge • Very important 	<ul style="list-style-type: none"> • I appreciate • Very important • Obligatory if the need of the child is to be met • Very motivational • We do not have the technology. • But facilities should be fulfilled first • The Ethiopian MOE had an immediate goal for using IT with secondary and not primary schools.
Researchers comments	<ul style="list-style-type: none"> • Students seem quite happy to work with computers • Students feel a sense of pride when sitting at computers. • There however is a big fear that novelty effect might be there with the students' lavish interest to the machine. 	<ul style="list-style-type: none"> • Most of the teachers agree that computer use for classroom purpose is very important. • Some also think that the effort will only be doomed to nothingness. • Others have the feeling that today's children can only be motivated by a simplistic approach to ways of doings using the technology.

In responding when questioned about their attitudes on the use of CAI both the students and the teachers responded positively with the common phrases very important; appreciate; very motivational; makes things brief; lots of information in computers; quick understanding of concepts by students; and so on.

However, some teachers are very critical about using computers in their schools for CAI purposes. Raising question of feasibility, such teachers dare say little positive terms about CAI programs. They stress that the country does not have the technology. Sensible enough, here is the idea of one veteran school teacher whose words go as “ If we are to meet the need of today’s

children, it appears obligatory to bring computers into our classrooms. Today we have only children who really want to sit down and watch while their grand parents toil hard....”

The above argument might appear much funny and not workable. Nonetheless, the present world has many of such symptoms and there is a lot of truth in it. In this regard, it is the task of the present generation to check if hard work is the ethics of our primary school children today. It is just a warning that not attempting to use computers for instructional provision in our primary schools is the more evil. Non- use of the technology results not only in lagging behind the time but it is also a question of survival as globalization is going to make it so. After all, it is this age when man lays the important basis.

The writers comment in relation to the reaction of teachers and students towards CAI use is the following. Where as students are very touchy with the programs, teachers seem to have big doubt which might have outgrown their little knowledge and skill in relation to the use of the machine, their general fear that our economy might not afford to and may be the so called the fear of the unknown world of computers.

4.3.Presentation and Analysis of the Response Obtained by

Observing CAI Classrooms

As indicated in the design section, this part of the analysis and presentation follows a computation of the median, weighted mean and variance of evaluators’ rating scores on the quality of CAI programs in the schools against the assumed neutral or midpoint in each scale category on the one hand and among the group mean differences. The three groups who rated the same classroom lessons were the CAI teachers, the non-CAI teachers, and the external evaluator. The last one in the case of this study is the researcher himself who rated each of the instructional

provisions offered by the CAI teachers. Throughout the analysis of the mean ratings of the three evaluating groups, the analysis of variance (ANOVA) and wherever required its further analysis (in this case the Tukey test) had been computed. The ANOVA had its null hypothesis that:

THERE IS NO STATISTICALLY SIGNIFICANT DIFFERENCE AMONG THE MEAN RATINGS OF THE THREE GROUPS IN EVALUATING THE CAI PROGRAMS IN THE SUBJECT SCHOOLS.

Table 10. Mean Standard deviation, median scores and F values for the evaluating groups rating on **Knowledge (Cognitive) Aspects** Included in the CAI lessons Observed

Scale Category 1

Scale Category 1.	CAI Teachers		Non-CAI Teachers		The researcher		F computed	F Critical
	Mean	SD	Mean	SD	Mean	SD		
Knowledge (cognitive) aspects included	23.73	5.01	23.53	1.45	23.47	2.12	0.03	3.23
(P, 0.05;df=43) The respective median scores are: 26, 24 and 24.								

Rating on this category the maximum and minimum results to obtain respectively are 30 and 6. In the summary table above the average results of CAI teachers, non-CAI teachers and the researcher are 23.73, 23.53 and 23.47 respectively. This shows a very high level of agreement above the point of neutrality eighteen, which is obtained by dividing the sum of the minimum and maximum possible scores in the scale category by two. For example, in this case it is $[(30+6)/2]$.

In this regard, all the three groups of evaluators agreed that the CAI programs in the schools have included the three domains of knowledge in a way that is required. That is there are teaching points of the type knowledge, attitude and skills. Further, the F test indicated that at α level of 0.05, we are quite certain that the difference in rating is only attributed to sampling errors (i.e. Observed $0.03 < F_{tab} 3.23$). So, in this regard the CAI observed showed a good deal of quality. The researcher attributes the high rating results on this category of the scale to the fact that the

instructional software for use in the lessons observed were not only designed with a good deal of narratives on various topics but also they have the power to capture learners' interests. While at the same time engaging learners to continuously think and respond using the light ray or by writing a piece of information on space provided on the screen of the machine.

Table 11. Mean, standard deviation, median and F values for the evaluating groups rating on Quality of the CAI program content Observed

Scale Category 2

Scale Category 2	CAI Teachers		Non-CAI Teachers		The Researcher		F observed	F critical
	Mean	SD	Mean	SD	Mean	SD		
	45.47	5.68	37.67	3.91	42.20	7.08	6.60	3.23

(P<. 05; n1=15;n2=15;n3=15;df=43) The median scores respectively are: 44,37, and46.

When rating on this category of the scale the maximum and the minimum scores respectively are 55 and 11.

In the summary table above the average rating results of CAI and non-CAI, teachers respectively are 45.47 and 37.61. These figures are far greater than the median score 33. This indicates that the respondent teachers believe that the contents of the CAI in their school are highly valuable. The rating on this same category by the researcher, on the other hand, averaged by far greater than not only the median score of this portion of the scale but also the average ratings of non-CAI teachers. It amounted 42.20 and therefore strengthens the teachers' opinion that the contents of CAI programs in their classrooms are very good.

Nevertheless, the mean scores of the three groups indicated a significant difference at an alpha level of 0.05 with F obtained 6.60 and F tab=3.23. Thus, it was found necessary to compute the

Tukey test to see the existing differences among the three groups. In table 12 below whereas CAI teachers rated the quality of CAI program content significantly higher than non-CAI teachers did, the researcher rated it nearly the same to both groups. This was identified by comparing the differences between group means against the computed critical values taken for differences arising only from sampling error.

Table 12. Test result for critical mean differences rating on CAI Program Content

	CAI Teachers	Non-CAI Teachers	Researcher as an evaluator	Computed critical value
CAI Teachers	--	7.80	3.27	5.26
Non-CAI teachers	*	7	4.53	
Researcher as an evaluator	*	*	--	

Here it may be said that the program content of CAI in the schools are well and good. However, the close examination of each item in the scale category shows some poor quality of the programs. In this same section, two sub items had been poorly rated. The first point is that the software's included only little practice exercises in a way of helping the learners achieve their objectives. This is against the suggestion of most instructionalists. Secondly, the materials are not modified locally. The implication is that since the educational software are prepared in a foreign context; they lacked relevance to the social, cultural, and economic realities of the Ethiopian society. In schools like Sanford International, this might not as such be out of purpose because the school has also the objective of preparing students for the SAT. Nonetheless, as most of the students are Ethiopians and they remain Ethiopians, they can only be intrinsically motivated to the Ethiopian tastes. This problem though not much, is shared by the rest three subject schools. The researcher has felt it that the instructional software reflecting much of the British and American context are in use in all these schools with little or no modification practically possible to be done on them.

Table 13. Means, standard deviations, and F values for the evaluating groups rating on **Quality of CAI Instructional Design** observed

Scale Category 3

Scale Category ³	CAI Teachers		Non-CAI Teachers		The Researcher		F observed	F critical
	Mean	SD	Mean	SD	Mean	SD		
Quality of CAI Design	23.33	2.91	18.60	1.74	19.67	2.00	31.34	3.21
(P<. 05; n1=15;n2=15;n3=15;df=43) The respective median scores are: 23, 19, and 21.								

Rating on this category of the scale one can get a 30 maximum and a 6 minimum result. In the table above the respective average ratings of the CAI and Non-CAI teachers is 23.33 and 18.60. While the CAI teachers rated well above it, the non-CAI teachers did a little greater than the median value 18. In any case, the teacher respondents showed their agreement to the idea that the CAI programs in their schools have good instructional designs. Here the external evaluator rated 19.67, which is only a bit above the median score 18. As a whole, the fact that the three groups rated not much higher than the point of indifference can be attributed to the fact that the software used did not properly address level of difficulty issues. For example in educational software presented to grade 8 students for their chemistry lesson is difficult to be understood by the students. The students were doing nothing in response except that they gazed at the picture and sound repeatedly. As such no related practice, exercises were there in spite of the fact that most instructionlists persist this and immediate feedbacks to be crucial factors in learning.

In the same table above, the F test at an alpha level of 0.05 proved that there is a significant difference among the mean ratings of the three evaluating groups. In a further analysis of the existing mean difference, the table below indicated that the rating of the two groups of evaluators were found to be significantly lower than that of the CAI teachers. This result can normally be

attributed to the very assumption of this same evaluation model that the CAI teachers tend to rate in favor of the program.

Table 14 . Test result for critical mean differences ratings on quality of CAI design

	CAI Teachers	Non-CAI Teachers	Researcher as an evaluator	Computed critical value
CAI Teachers	-	4.73	3.66	1.87
Non-CAI teachers	*	-	1.07	
Researcher as an evaluator	*	*	-	

Table 15. Mean, standard deviations and F values for the evaluating groups rating on **CAI Ease of Use Observed**

Scale Category 4

Scale Category 4	CAI Teachers		Non-CAI Teachers		The Researcher		F observed	F critical
	Mean	SD	Mean	SD	Mean	SD		
Ease of Use	29.40	2.80	14.4	1.25	18.13	1.41	72.34	3.23
(P<. 05; n1=15;n2=15;n3=15;df=43)The respective median scores are: 19,14 and18.								

Rating on this category of the scale one obtains a maximum score of 25 and a minimum score of 5. In the table above, the CAI teachers and the researcher scored respective average ratings 29.47 and 18.13. Both of these scores are above the point of neutrality in the scale category, which is 15. This indicates that the two groups agreed with the fact that the CAI program in the schools posed little difficulty for use. The non-CAI teachers rated this category of the scale only 14, which is not only below the median score 15 but showing a wide variation particularly from the mean rating scores of the CAI teachers.

This in the researcher's observation could be attributed to the insufficient networking and repairing service available in some of the schools. Moreover, at this point, the researcher thought the fact that the non-CAI teachers appeared to have received relatively lesser training made them to give high regard to the difficulty of the technology during their classroom observation.

On the other hand, in most of the classroom observations made, the educational CDs under use have been found outorun. Thus, they required little setting up procedures. Although this is verifying that the instructional software's observed are easy to use, the absence of clear and useful manuals with some of the educational CDs was noted creating a common problem to both students and teachers

The F obs. 72.34 exceeded the F tab. 3,23 indicating the presence of a worth considering variation among the mean ratings of the three evaluating groups. In a further analysis of the existing difference among the means table 16 below indicates that both Non-CAI teachers and the researcher rated the CAI program ease of use significantly lower than the CAI teachers, without showing a notable difference between the ratings of the former two.

The high rating very close to the maximum score by the CAI teachers could be due to either or both of their acquaintance to the program on the one hand and to the assumption in the model on the other hand.

Table 16. Test result for critical mean differences of ratings on **CAI Ease of Use**

	CAI Teachers	Non-CAI Teachers	Researcher as an evaluator	Computed critical value
CAI Teachers	-	15.00	11.27	7.65
Non-CAI teachers	*	-	3.73	
Researcher as an evaluator	*	*	-	

Table 17 Means, standard deviations, and F values for the evaluating groups rating on **Quality of CAI Program Management**

Scale Category 5

Scale Category 5	CAI Teachers		Non-CAI Teachers		The Researcher		F observed	F critical
	Mean	SD	Mean	SD	Mean	SD		
Program management qualities of CAI	19.87	4.87	12.60	1.02	17.47	2.92	17.31	3.23
(P<. 05; n1=15;n2=15;n3=15;df=43)The respective median scores are:18,13 and18.								

Rating on this category of the scale the respective maximum and minimum results to be obtained are 30 and 6. In the preceding table, the mean rating score of CAI teachers is 19.87. This figure is a little greater than the median value 18. However, while the researcher rated slightly below the median score, non-CAI teachers really rated it far below 18 about 12.60. As a whole, the three groups rated the program management of the CAI in their schools either in a state of indifference or as poor in quality.

Moreover, the three parties unanimously rated low scores on issues of program branching based on student score and on availability of entry level testing. This point substantiates the low ratings made on issues of controlling rate, sequence and level of difficulty of programs under the category quality of instructional design. In most of the educational CDs a linear approach was noted in the program management and this has a huge implication to whether or not the CAI provisions in the schools are achieving the aim for which they were brought to the classrooms. In other words, the educational CDs observed consisted of less-reflective learning environment. They also appear to give little emphasis to the concept of learning how to learn.

The ANOVA at an alpha level of 0.05, an F observed 17.31, and F critical 3.26 indicates that there is a significant difference among the ratings. Further test of analysis was done to indicate that the non-CAI teachers rated significantly below the two other groups which themselves showed insignificant difference. This test result in table 19 below substantiates the discussion above along with the assumption of the model that the non-CAI teachers rate the program more critically.

የኢትዮጵያ ፌዴራላዊ ዲሞክራሲያዊ ሪፐብሊክ
የትምህርት ሚኒስቴር
የትምህርት ፖሊሲና ስልጠና ኮሚሽን

Table 18. Test for Critical mean differences of ratings on **quality of CAI program management.**

	CAI Teachers	Non-CAI Teachers	Researcher as an evaluator	Computed critical value
CAI Teachers	-	7.27	2.40	3.06
Non-CAI teachers	*	-	4.87	
Researcher as an evaluator	*	*	-	

Table 19. Means, standard deviations, and F values for the evaluating groups rating on **Motivational Aspects Included in the CAI lessons Observed**
Scale Category 6

Scale Category 7	CAI Teachers		Non-CAI Teachers		The Researcher		F observed	F critical
	Mean	SD	Mean	SD	Mean	SD		
Motivational quality of the CAI provisions observed	22.53	2.39	23.60	0.49	22.60	2.58	0.87	3.23
(P<. 05; n1=15;n2=15;n3=15;df=43) The respective median scores are: 13, 8 and 13.								

Rating on this category of the scale the respective maximum and minimum scores to be obtained are 25 and 5. In the table above CAI and non-CAI teachers and the researcher rated respective average rating scores of 22.53, 23.60 and 22.60. These figures are well above the median value 15. This means all the three groups agreed well that the CAI programs in their schools are highly motivational. The F test in table 19 above showed that there is insignificant difference among the mean rating scores by the three groups. This strengthens the foregoing discussion.

However, the researcher had a fear that novelty effect on the part of the learners might have resulted the above score. For example in one of the schools, the researcher had a chance of visiting a special CAI program prepared on one of the school subjects. There the number of Participating students not only showed inconsistency but it had also shown a sudden fall from over twenty to five.

Table 20. Mean standard deviation and F ratio for the evaluating groups rating on **Technical Aspects of CAI lessons Observed**
Scale Category 7

Scale Category 7	CAI Teachers		Non-CAI Teachers		The Researcher		F observed	F critical
	Mean	SD	Mean	SD	Mean	SD		
Technical Qualities of CAI programs observed	12.80	2.07	7.67	0.60	12.67	1.19	59.23	3.23
(P<.05; n1=15;n2=15;n3=15;df=43)								

Rating on this category of the scale, the respective maximum and minimum scores that one can obtain are 15 and 3. In the table above, the CAI teachers and the researcher scored an average of 12.80 and 12.67 scores respectively. While these scores are a bit higher than the median value 9, the non-CAI teachers rated a bit less than the median value. The further analysis in table 21 below witnessed a significant difference that the mean ratings of non-CAI teacher evaluators scored. This in the analysis of the researcher emanated from same assumptions of the model. In addition to this however, the points following the table below appear to have affected the rating results and particularly of the non-CAI teachers.

Table 21. Test result for **critical mean differences of ratings on technical qualities of CAI.**

	CAI Teachers	Non-CAI Teachers	Researcher as an evaluator	Computed critical value
CAI Teachers	-	5.13	0.13	1.31
Non-CAI teachers	*	-	5.00	
Researcher as an evaluator	*	*	-	

In some cases, the instructional programs were locked by passwords by the publishers themselves. Absence of proper networking of PCs with a centrally arranged main server computer for the classroom teacher, and the living problem of getting stand by and reliable repair services in the middle of the lesson pose the biggest problems.

CHAPTER FIVE

5. Summary, Conclusion and Recommendations

5.1 Summary

5.1.1 Objective and Methodology of the Study

This study aimed at analyzing the experience of Addis Ababa and Awassa Non-government primary schools in using computers for supplementing their instructional provisions. It does so because in case the experiences deserve praise, other schools of similar nature and there by all other Ethiopian Primary schools will get it an important basis for adopting the instructional technology. On the contrary, if the experience shows failure the study will pin point out this and suggest solutions.

The study thus, attempted to assess the experience of Addis Ababa and Awassa non-government second-cycle primary schools in using CAI.

The researcher with the above purpose of examining the efforts in employing CAI in the schools coined the following basic questions:

- i. What procedures do Addis Ababa and Awassa Non-government primary schools under reference follow in employing computers for supplementing classroom instruction?
- ii. How do they manage problem of cost prohibitive ness?
- iii. How much and how well are computers in use in the subject primary school?
- iv. How much appropriate are the instructional programs in use by the subject schools?

v. What is the reaction of the students to the programs?

vi. What is the reaction of the teachers and school personnel's to the program?

Just by putting together the relevant points from the four models: a model for evaluating educational innovation, a model for evaluating CAI, a communication model, and an IT model, the writer adopted his own model for evaluating computer-assisted instruction as one form of instructional technology. This present model attempts to evaluate the instructional technology from four perspectives: learners, teachers who use CAI, teachers who do not use CAI, and an external evaluator who could be the researcher himself.

The latter three groups of evaluators assess the quality and quantity of the details under each of the four phases: preparation or situation analysis, planning, implementation, and evaluation. These details had been thoroughly discussed under the review of literature subsection titled "What and when to evaluate?" The writer had also attempted to put the whole process of such an evaluation in the form of diagram under the methodology section.

It had thus examined what was going on in the classrooms of these schools using both qualitative and quantitative measures. The qualitative aspect involved open-ended and semi-structured interviews as well as focus group discussions to Both CAI and Non-CAI schoolteachers, principals, and students in a way that the study can bring the critical reflections of all these respondents and the researcher himself on the volume as well as quality of CAI programs under practice in the subject schools. The researcher had also attempted to assess the reactions of students and teachers about CAI provisions in their schools. Overall, in addition to the researcher, 32 students, 4 principals, 15 CAI and 15 Non-CAI teachers responded to the instruments used. See table 1 on page 51.

The quantitative aspect followed the measurement of the judgment of the CAI and Non-CAI teachers, and the researcher as an external evaluator on the quality of CAI program under offer in these schools focusing on seven important aspects of a quality CAI that were stipulated by writers in the area. This was done using a five point Likert type scale with 42 items that were distributed to the available 15 CAI teachers and equal number of Non-CAI teachers in same schools and the researcher's 15 independent observations of CAI classes in the same schools. While the above tripartite evaluation was recommended by the model followed, painstaking validations of the instruments had been achieved before a move was made into the actual data collection process.

5.1.2 Major Findings of the Study

Thus, the schools had just entered into the use of computers for use following their access to the equipments from various sources on various occasions. No formal situation analysis were made by these schools except that they had already realized that they may loose at least some of their students if they do not urgently employ the technology for instructional provision too.

Thus, the blind rush towards making use of CAI software had not been compared with low-cost but highly effective teaching medium, such as audiocassettes combined with print materials.

Interestingly enough it is important to underline the ways with which our primary schools attempted to provide computer access to their students in a condition of large class-sizes and the still expensive cost of computers. The schools use the computers in the IT room or rooms as well as human resources arranged for their upper grade secondary students. Further, they also have the strategy of dividing their students in a class in to two or more groups of smaller size during their CAI lesson arrangements so that the students can work for one two or three per computer. What

was even more interesting during the observation of CAI use in the subject schools was that the relatively able schools buy new computers and use the older versions for basic skill trainings. This might not directly cut cost yet it had a sign of efficiency.

The study tells us that except in few schools in the country, most of which may not even be good representatives of the rest Ethiopian schools due to their financial and thereby other related capacities; the use of computers in our primary schools is so minimal that they are only exploited to their potential of word processing. Of course there are computers and one or more computer rooms in each of the schools. Their number and version as well as the usage type and level vary within the four schools following their financial capacity and the capacity of their staff. The use of computers for classroom teaching in these schools was limited to basic computer skill training except that some teachers attempt to make use of available educational CDs in resource centers very occasionally.

Presently the use of computers for classroom purposes in Addis Ababa and Awassa non-government second-cycle primary schools had been found limited mainly to their use for training students basic computer skills and for search purposes as well as for word processing by both the students and their teachers writing test questions and very rarely writing notes. The teachers appeared to have little impression about what other thing computers could do for improving their instructional provisions while they can use such programs as Micro Soft Access, Excel and Power point for various purposes. Thus, CAI provisions are at their trial stage on informal basis by individual schoolteachers who had the initiation for it. It is a trial stage in that the teachers were found to use it very infrequently or even some times only when external visitors, such as the writer of this paper reminded them of its use.

The volume and quality of CAI use can also be seen from the preconditions met for it. In all the four schools the CAI teachers identified themselves as having at least a self-training of basic computer skill training. These teachers then showed the initiation of using the educational software

that are made available to them in the resource centers. Still others were noted to use the machine for programs, such as "Mega.Byte Mathematics", simulating chemical reactions in chemistry or demonstrating the concepts mass and motion in physics in the natural science, and demonstration of historical and geographical facts such as "The Weather" and "Ancient and Medieval History of the World" in the area of social studies. "Mega Byte mathematics" is a program in which students are helped to work with mathematics word problems on computer screens.

Even then, these little experience of CAI use in our schools had big reputations as well as shortcomings. They had been noted to be of much help for students to learn concepts quickly and accurately. The programs were also able to demonstrate the immense motivation that our students had to CAI in particular and what is technology in general. However, not all the observed programs were found to be up right in every sense.

First, the CAI programs in the schools were found including knowledge aspects from all the three categories of knowledge (i.e. knowledge, skills and attitudes). The statistical analysis made for comparing the results of the three evaluating groups in this regard witnessed the three mean values closely fall 23. In brief, the F_{tab} value 3.23 exceeded the F_{obs} 0.03-value indicating that the difference among the three means is only because of sampling error.

Second, the three evaluating groups rated the quality of CAI program contents in their school well over the point of neutrality, which is 33. The CAI, and Non-CAI teachers as well as the researcher rated it 45.47, 37.61 and 42.20 respectively. This indicates that the evaluators believe that the contents of the CAI in their school are highly valuable. At the same time, although, the mean scores of the three groups indicated a significant difference at an alpha level of 0.05 with F obtained 6.60 and $F_{tab}=3.23$, the Tukey test in table 12 on page77 indicated the difference to be

negotiable. In other words, whereas CAI teachers rated the quality of CAI program content significantly higher than non-CAI teachers did, the researcher rated it nearly the same to both groups. This was identified by comparing the differences between group means against the computed critical values taken for differences arising only from sampling error.

However, the close examination of each item in this same scale category, showed some poor quality of the programs. For example, two sub items had been poorly rated. The first point is that the software's included only little practice exercises in a way of helping the learners achieve their objectives. This is against the suggestion of most educationists. Secondly, the materials are not modified locally. The implication is that since the educational software's are prepared in a foreign context, they lacked relevance to the social, cultural, and economic realities of the Ethiopian learners.

Third, Rating on the quality of CAI design, all the three evaluating groups rated it nearly close to the point of indifference, which is 18. Their respective scores were 23.33, 18.60 and 19.67. In any case, the teacher respondents showed their agreement to the idea that the CAI programs in their schools have good instructional designs. Here the external evaluator rated 19.67, which is only a bit above the median score. 18. The fact that the three groups rated not much higher than the point of indifference can be attributed to the fact that the software used did not properly address level of difficulty issues. For example, the educational software presented to grade 8 students for their chemistry lesson was difficult to be understood by the students. The students were doing nothing in response except that they gazed at the picture and sound repeatedly.

More on this, the F test at an alpha level of 0.05 proved that there is a significant difference among the mean ratings of the three evaluating groups i.e. F obs. 31.34 exceeded F tab. 3.21. In a

further analysis of the existing mean difference, table 14 on page 79 indicated that the ratings of the two groups of evaluators were found to be significantly lower than that of the CAI teachers. Thus, according to the model that this research is following, the quality of the CAI design in these schools will be more under question as it got less marks from its implementers than the external evaluator and the non-participating teachers.

Fourth rating on CAI ease of use the non-CAI teachers rated this category of the scale only 14, which is not only below the median score 15 but showing a wide variation particularly from the mean rating scores of the CAI teachers. The latter group and the researcher rated it respective score of 29.47 and 18.13 both of which are far above the median point witnessing that the use of the programs pose little difficulty.

This in the researcher's observation could be attributed to the fact that the non-CAI teachers appeared to have received relatively lesser training. This, no question can make them to give high regard to the difficulty of the technology during their classroom observation. Of course there are other points too including the absence of clear and useful manuals with some of the educational CDs was noted creating a common problem to both students and teachers. Tables 15 and 16 on pages 79-80 both strengthen the idea that the non-CAI teacher's high regard to the difficulty of using CAI programs in the class. In other words, the F_{obs} 72.34 exceeded the F_{tab} 3.23 and the Tukey test indicated both Non-CAI teachers and the researcher rated the CAI program ease of use significantly lower than the CAI teachers, without showing a notable difference between the ratings of the former two.

Fifth, rating on the quality of the CAI program management the respective scores for the three groups: 19.87, 17.47, and 12.60 were all either about the median 18 or far below it. Moreover, the three parties unanimously rated low scores on issues of program branching based on students'

score and on availability of entry level testing. The ANOVA at an alpha level of 0.05, an F observed 17.31, and F critical 3.26 indicates that there is a significant difference among the ratings. Further test of analysis was done to indicate that the non-CAI teachers rated significantly below the two other groups which themselves showed insignificant difference. This test result can be seen from table 19 on page 82.

Sixth, rating on the motivational quality of CAI programs under offer; CAI and non-CAI teachers and the researcher rated respective average rating scores of 22.53, 23.60 and 22.60. These figures are well above the median value 15. This means all the three groups agreed well that the CAI programs in their schools are highly motivational. The F test in table 19 on page--- showed that there is insignificant difference among the mean rating scores by the three groups so boldly that F obs.0.87 is even accepted at more relaxing alpha levels. This strengthens the foregoing discussion.

However, the researcher had a fear that novelty effect on the part of the learners might have resulted the above score. For example in one of the schools, the researcher had a chance of visiting a special CAI program prepared on one of the school subjects. There the number of Participating students not only showed inconsistency but it had also shown a sudden fall from over twenty to five.

Seventh, rating on the quality of the technical aspects of CAI programs in the schools, the three groups scored a respective score of 7,12.80 and 12.67. The F test and the further analysis in tables 20 and 21 on page 83 witnessed a significant difference that the mean ratings of non-CAI-teacher- evaluators scored against the median value 9. These low rating scores resulted from points, such as instructional programs locked by passwords, absence of proper networking of PCs with a centrally arranged main server computers for the classroom teachers, and the living

problem of getting stand by and reliable repairing services in the middle of the lesson posing the biggest problems. Common as these factors may be to the other groups of evaluators, they did not reveal as such serious impacts on their ratings.

Of course, they had shown clear weakness of following linear program, failure to contextualize contents to the Ethiopian objective realities, failure to provide pedagogically valid lessons (i.e. providing enough opportunities of practicing the targeted skills), failure to provide immediate feedbacks and failure to recognize the maturity levels of the learners.

On the other hand, their application in the classroom situations was noted not as such difficult and the procedures to follow have commonly been found with very handy pieces of publications that were procured with the CDs themselves. In other words, operating the program is not as such demanding sophistication in computer science.

Moreover, the students and the teachers exhibited positive attitudes towards CAI. The teachers believed that this new instructional provision creates a sort of convenience in their work. They think that it would enable them capture the interest of their learners more than ever. Obviously, the teachers showed big interest in trainings provided in the area.

5.2 Conclusion

The use of computers in our primary schools is so minimal that they are only exploited to their potential of word processing. In Ethiopia, technology particularly in the field of education is at its embryonic stage. This makes all technology-based practices to pose living problems of cost. In this context, attempts of employing computers for supplementing classroom instructions may be expensive but refraining from using the technology may not result in simple backwardness but it

may result in a question of survival as the move towards Globalization naturally makes it so. Here is a point where the writer got it quiet appropriate to mention three quotable quotations in support of the foregoing idea irrespective of the time laps and the theme for which the first two were uttered out.

” If you think education is expensive try ignorance”(Derek Bok, President Harvard)

“What do we want? Everything! Now! “(Nelson Andrews, Chair, Tennessee State Board of education

“ If we are to meet the need of today’s children, it appears obligatory to bring computers into our classrooms. Today we have only children who really want to sit down and watch while their grand parents toil hard....”(a retired veteran Ethiopian primary school teacher).

The above counts positive to those Ethiopian primary schools that had already shown enthusiasm for the technology and those that had already taken the single-step-huge-leap in the history of Ethiopian primary education system. This is bringing computers into the classrooms.

However, this should not mean that the schools do not need to examine their objective realities. They need very carefully think over on their existing human and material resources and take the necessary measures before they hurriedly implement CAI as one form of IT

The reason for this is that not carrying out needs assessment hinders their possibility of considering alternative and low-cost but highly effective teaching medium, such as audiocassettes combined with print materials.

Interestingly enough it is important to underline the ways with which our primary schools attempted to provide effective and efficient use of their few computers after they got them on various ways.

However, the teachers appeared to have little impression about what other thing computers could do for improving the instructional provisions. Thus, the use of computers for supplementing instructional provisions in these schools are at their trial stage on informal basis by individual schoolteachers who had the initiation for it. It is a trial stage in that the teachers were found to use it very infrequently or even some times only when external visitors, such as the writer of this paper reminded them of its use.

Moreover, not all the observed programs were found to be up right in every sense. Of course, some appeared difficult and others lacked relevance with the Ethiopian context.

Lastly, the students and the teachers exhibited positive attitudes towards the use of computers for supplementing classroom instructions. The teachers believed that this new instructional provision creates a sort of convenience in their work. They think that it would enable them capture the interest of their learners more than ever. Obviously, the teachers showed big interest in trainings provided in the area

5.3 Recommendations

Now that time had come. Literatures were reviewed, data were collected and analyses were made. The preceding sections were on the findings obtained and conclusion reached. The suggestions and recommendations below follow.

a) Whereas it is praise worthy that Ethiopian primary schools had the biggest desire of supplementing their regular instructional provision with CAI, they should also be reminded of the fact that merely having the machines at hand does not suffice.

The schools need very carefully think over on their existing human and material resources and make the necessary preparations before they hurriedly implement CAI as one form of IT. For example schools:

- Can take time and consider other alternative low-cost but highly effective instructional media, such as audiovisuals combined with print materials.
- Can look for ways of arranging in-service teacher training programs for their schoolteachers who had both the interest and commitment to CAI provisions.
- When however the schools are to decide to use CAI, they might have the difficulty of considering CAI due to its costly nature. Yet, primary schools can look for ways in which they can use the IT rooms of their respective secondary schools to educate their younger students and thereby use CAI.
- . Equally, they can influence teacher education institutes to provide related training by hiring only those teachers who had taken at least some instructional technology courses during their college stay.

b) Following the careful examinations of the ways the subject schools of this study managed the problems they encountered in employing CAI, the researcher hereby recommends all other Ethiopian primary schools that intended to use CAI to share experience from these schools. In brief the areas on which to share ideas are how to get computers large enough for students of the level in a limited financial capacity, how to get educational publications of the particular kind as well as how to get these match the curriculum in use in Ethiopia.

c) The use of CAI in the Ethiopian primary schools today is too young. It is only at its trial state by some self-initiated teachers in the schools. If these attempts are to bear any fruit, schools should get the necessary encouragement by the Ethiopian Ministry of Education. The schools in turn need supply the teachers showing the initiation with the required in-service trainings in co-ordination with the higher education institutions having the program of instructional technology.

To this effect, colleges of teachers' education in the country are quite advised to commence well-organized instructional technology course provisions to both preserves and in-service teacher education programs.

d) The educational CDs in use in the few Ethiopian primary schools today are foreign publications. They are prepared in a very different context to be of good use for students in Ethiopia. One can dare say that their contents are irrelevant to our curriculum. In this case, as long as our teachers are incapable of making the required modifications to the materials, it appears advisable to keep these as additional resources only. To this end, our schools need get a syllabi developed for offering CAI lessons in advance for those who show the initiation to implement it.

In this respect, the educators of this country should boldly face the big challenge in an effort of providing useful and timely education to the Ethiopian child. Among these is the proper designing of CAI for lower grade students, which in turn requires well-educated instructionalists that are devoted to the purpose. In addition to this doing researches in the area of both print and online instructional designs is what is required of them.

e) Both students and teachers in Ethiopian primary schools today appear to have an amazingly keen interest to CAI use and of course, to all what is technology. Thus, the

concerned educators of the country should make use of this favorable opportunity for laying a firm ground to latest instructional technology in use in primary education system of Ethiopia.

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Appendix A

Addis Ababa University
School of Graduate Studies
College of Education
Department of Curriculum and Instruction

A Checklist to be filled by Primary School Teachers who use
Computers-assisted -instruction.



Purpose:

The main objective of this questionnaire is to collect first-hand information for the study on "The Experience of Addis Ababa and Awassa Non-Government second-cycle Primary Schools in Using Computer-Assisted instruction." Your co-operation in providing pertinent and reliable information is expected to have a paramount value for the study. Therefore, please fill out the checklist completely and honestly. You do not need to include your name. Level of education: 12+ _____. Graduated in Major: _____ minor: _____. Subject to teach: _____ years of experience as a teacher: _____ Type of training you have in relation to computer use: _____.

Thank you in advance for your time and concern

The questions below relate to cognitive aspects included, the program content, the instructional design, ease of use, program management, motivation and technical aspects.

INSTRUCTION:

In the following scale the numbers stand for column headings. Accordingly:

5= Strongly Agree

4 = Agree

3= Undecided

2= Disagree

1= Strongly Disagree

Please respond by encircling either number at the end of each item in the list.

	Points to be checked or rated	5	4	3	2	1
1	Knowledge categories included /general and specific /	5	4	3	2	1
	1.1. Factual information	5	4	3	2	1
	1.2. Visual identification	5	4	3	2	1
	1.3. Principles, concepts and rules	5	4	3	2	1
	1.4. Learning procedures	5	4	3	2	1
	1.5. Skill-perceptual motor acts	5	4	3	2	1
	1.6. Attitudes-opinions and motivation	5	4	3	2	1
2	Program Content	5	4	3	2	1
	2.1. Objectives are clearly defined	5	4	3	2	1

	2.2. The contents are educationally significant	5	4	3	2	1
	2.3. Suitable to age level of learners	5	4	3	2	1
	2.4. Appeal to the interest of students	5	4	3	2	1
	2.5. Unnecessary redundancy are removed	5	4	3	2	1
	2.6. Contents are sequenced appropriately	5	4	3	2	1
	2.7. Practice activities and exercises fit objectives	5	4	3	2	1
	2.8. Contents are modified locally	5	4	3	2	1
	2.9. Free from (sex, race, sexual, etc) stereotype	5	4	3	2	1
	2.10. Program involve students well	5	4	3	2	1
	2.11. Post tests exist to measure attainment	5	4	3	2	1
3	Instructional Design	5	4	3	2	1
	3.1. CAI approaches such as drill-and-practice are used effectively	5	4	3	2	1
	3.2. New information presented relating to previous ones	5	4	3	2	1
	3.3. Feedbacks are used appropriately	5	4	3	2	1
	3.4. Control rate, sequence and level of difficulty is possible	5	4	3	2	1
	3.5. Summaries and reviews are available	5	4	3	2	1
	3.6. Varieties of displays: sound, color and appropriate response modes exist	5	4	3	2	1
4	Ease of Use	5	4	3	2	1

	4.1. Students can use program independent of their teacher or manual	5	4	3	2	1
	4.2. Help procedures are available on line	5	4	3	2	1
	4.3. Students can move forward, backward or to the menu	5	4	3	2	1
	4.4. Clear and useful manual is available	5	4	3	2	1
	4.5. Directions are clear	5	4	3	2	1
5	Program Management	5	4	3	2	1
	5.1. Students move through program contingent on progress	5	4	3	2	1
	5.2. Accurate and useful records of responses are possible to keep	5	4	3	2	1
	5.3. Program branches appropriately based on student scores	5	4	3	2	1
	5.4. Program handles a wide variety of student responses	5	4	3	2	1
	5.5. Provides diagnostic (entry level) testing	5	4	3	2	1
	5.6. Allows for effective co-operative leaning or competition	5	4	3	2	1
6	Motivation	5	4	3	2	1
	6.1. Program holds student attention, keeping students on task	5	4	3	2	1
	6.2. Program does not demean or insult students	5	4	3	2	1
	6.3. Program preserves students activities (e.g. No loud noise)	5	4	3	2	1
	6.4. Program is intrinsically motivating	5	4	3	2	1
	6.5. Makes learning fun	5	4	3	2	1
7	Technical Aspect	5	4	3	2	1

7.1. Screen displays are effective	5	4	3	2	1
7.2. Programs are free of unnecessary delays (e.g. Slow loading of graphics)	5	4	3	2	1
7.3. Program does not crash easily	5	4	3	2	1

For point that you rated "undecided" please explain your reason. _____

Thank you again for your co-operation

Appendix B

Addis Ababa University

School of Graduates

College of Education

Department of Curriculum and Instruction

Interview Questions for Principals or Vice of Primary Schools

Purpose:

This interview aims at assessing the experience of Ethiopian Non Government Primary School Principals or Vice Principals in employing computers in their educational provision.

Name of the school the interviewee works in: _____

Career position _____

Graduated in major: _____ Minor: _____

Years of service as a teacher _____ as a principals _____

Subject to teach at the time of the interview _____

Level and type of training in computer use _____

1. What conditions initiated you to use Computers in the program of your school? Discuss the procedure you followed in making use of computers in your schools.

2. What do you do with the computers in your school? _____

3. How many of the following facilities do you have in your school?

Computer rooms _____

Computers _____

Educational CDs _____

Teachers Guides (manuals) for CAI _____

Student text for CAI _____

4. Where do you get the above educational publications?

5. Have you ever arranged basic computer skill training for your teaching staff? Discuss in general about how many of the teachers in your school have at least basic computer knowledge and skills.

6. What is the ratio of computers to students in their computer assisted lessons?

7. What difficulties did you face in your attempt of using computers in your educational provision? _____

8. What are the mechanisms that you use to resolve or alleviate these problems?



9. What is your overall evaluation of computer use for instructional purpose in your school?

10. How do you evaluate the co-ordination among teachers, principals and computer lab technicians with regard to computer usage in your school?

11. How do you evaluate the student fee you collect from your students and the expenditure of your school on using computers?

Appendix C

Addis Ababa University
School of Graduate Studies
College of Education
Department of Curriculum and Instruction

Interview questions for CAI primary school teachers

Purpose:

This interview aims at assessing the experience of Ethiopian Non Government Primary School Teachers in Using Computers for Computer assisted instruction (CAI) Purpose.

Name _____ Level of education 12 + _____

Service as a teacher _____ subject to teach _____

Graduated in Major _____ Minor _____

Name of the school the interviewee works in _____

1. I have been informed by some of your school members that use computers for classroom teaching. In what way did you use the computers? Put a tick mark in the box or boxes

- | | |
|--|---|
| <input type="checkbox"/> Referring notes | <input type="checkbox"/> Simulating |
| <input type="checkbox"/> Writing notes and students' grade | <input type="checkbox"/> Playing Games |
| <input type="checkbox"/> Drill-and-practice | <input type="checkbox"/> Problem solving |
| <input type="checkbox"/> Giving tutorials | <input type="checkbox"/> Organize students data |
| <input type="checkbox"/> Demonstration | <input type="checkbox"/> Teaching Computer literacy |

Which are the grades that you use computers for instructional purposes?

2. How frequently do you use computers in a given classroom of yours?

- | | |
|---------------------------------------|--|
| <input type="checkbox"/> Every lesson | <input type="checkbox"/> Once in a month |
| <input type="checkbox"/> Once a week | <input type="checkbox"/> Once in a fortnight |

If any other, specify _____

3. What difficulties did you face in using computers for classroom purpose?

4. What mechanisms did you use to resolve the problems? _____

5. What differences have you noted in the overall progress of the teaching-learning process since your use of computers for the classroom purpose? _____

6. What do you say about the introduction of computers in to our primary classrooms and the fate of teachers to stay in their teaching position? _____

7. Have you ever talked to the principal or other teachers on issues of using computers for instructional purpose? Yes No

Appendix D

Addis Ababa University
School of Graduate Studies
College of Teacher Education
Department of Curriculum and Instruction

Interview questions for primary school teachers who do not use CAI.

Purpose:

This interview aims at assessing the experience of Ethiopian Non Government Primary School Teachers in Using Computers of Computer assisted instruction (CAI) Purpose

Name _____ Level of education 12+ _____

Service as a teacher _____ subject to teach _____

Graduated in major _____ Minor _____

Name of the school the interviewee works in _____

1. I have been informed that some teachers in your school use computers for the purpose of classroom teaching? For what different purposes did these teachers use the computers? Put a tick mark in the box or boxes below.

- | | |
|--|---|
| <input type="checkbox"/> Referring notes | <input type="checkbox"/> Simulating |
| <input type="checkbox"/> Writing notes and students grades | <input type="checkbox"/> playing games |
| <input type="checkbox"/> Drilling and practicing | <input type="checkbox"/> solving problems |
| <input type="checkbox"/> Giving tutorials | <input type="checkbox"/> organizing student data |
| <input type="checkbox"/> Demonstration | <input type="checkbox"/> learning computer literacy |

2. How frequently do these teaches use computers for instructional purpose?

- | | |
|---------------------------------------|--|
| <input type="checkbox"/> Every lesson | <input type="checkbox"/> ce in a month |
| <input type="checkbox"/> Once a week | <input type="checkbox"/> Once in fortnight |

If any other, specify _____

3. What difficulties did you have in using computers for classroom purpose in your school? _____

4. What mechanisms did your school use to resolve these problems?

5. What difference have you noted on the overall progress of the teaching learning process since some of your colleagues began using computers for their classroom purpose?

6. What do you say about the introduction of computers in to our primary classrooms and the fate of teachers to stay in their teaching position?

7. Have you ever talked to the principals or other teachers on issues of using computers for instructional purpose?

Yes

No

8. Do you have any more point to say on the attempt of using computers for our classroom purpose in general _____

Appendix E

Addis Ababa University

School of Graduates

College of Education

Department of Curriculum and Instruction

Focus-Group Discussion Questions for Students

The Amharic version for use with the students is found on the next page.

Purpose:

This interview aims at assessing the experience of Ethiopian Non Government Primary School Students in Using Computers in their classrooms.

Name of the school in which the pupil study _____

1. For what different classroom purposes do you use computer _____

2. In which of your school subject lessons do you use

computers? _____

3. Since which grade level have you started using computers in classroom? _____

4. What do you say about learning using computers as compared with learning without?

5. In your opinion, how much significant are the contents presented to you using computers? _____

6. Do you have a personal folder or document in any one of the computer? _____

7. What usual procedure do you follow in learning using computers? _____

Appendix F

Formula used

(i) Computing scale reliability

$$\alpha = \frac{K}{K-1} \left[1 - \frac{\sum S_i^2}{S_t^2} \right]$$

α = Scale reliability co-efficient of Crombach

K = number of respondents

S = Variance within individual item

S_t^2 = Sum of variances within individual items

$$\therefore \alpha = \frac{40}{40-1} \left[1 - \frac{39.66}{1017.17} \right]$$

$$\alpha = 1.03 (1 - 0.04)$$

$$\alpha = 1.03 (0.96)$$

$$\alpha = \underline{0.99}$$

- (ii) Computing item - total correlation / Pearson product moment correlation coefficient formula/.

$$r = \frac{\sum XY - (\sum X)(\sum Y)}{\sqrt{[n \sum X^2 - (\sum X)^2] [n \sum Y^2 - (\sum Y)^2]}}$$

Where X = respondents score per individual item

Y = total scores of respondents if particular item is dropped.

n = number of total respondents.

- (iii) Computing Inter-coder Agreement

$$\Pi = \frac{P_o - P_e}{1 - P_e} \quad \text{where } \Pi = \text{coefficient of inter-coder agreement}$$

$P_o = \text{observed percentage agreement}$
 $P_e = \text{expected percentage agreement by chance}$

$$\Pi = \frac{0.95 - 0.50}{1 - 0.50} =$$

$\Pi = 0.90$ i.e. 90% inter-coder agreement achieved by agreeing on

42 of the items from the original 44 items.

- (iv) Computing the F Ratio (F)

$$F = \frac{SS_b/df}{SS_w/df}$$

Where SS = Variance

t = Total

b = between group

w = within group

$$SS_t = \sum X^2 - \frac{(\sum X)^2}{N}$$

Where X = individual score in each group

N = total number of respondents in all the groups.

$$SS_w = \sum X_i^2 - \frac{(\sum X_i)^2}{n_i} + \sum X_{ii}^2 - \frac{(\sum X_{ii})^2}{n_{ii}} + \sum X_{iii}^2 - \frac{(\sum X_{iii})^2}{n_{iii}}$$

$$SS_b = SS_t - SS_w$$

(v) Computing the Tukey Test using a pair source comparison

$$CD \text{ Or } HSD = Q_{\alpha} \sqrt{\frac{MS}{WG}}$$

Where

Q_{α} = standardized range statistic from table

n = the number of cases in each group

HSD = Critical difference for comparison with absolute difference among means.

MS_{WG} = sum of the within group variance divided by its degree of freedom (i.e $N - K$ where N is total number of respondents and K is number of groups).

Appendix G

The Amharic Version of the Focus Group Discussion

በአዲስ አበባ ዩኒቨርሲቲ

የድህረ ምረቃው መርሐ ግብር

የሥቁ ት/ት/ኮሌጅ

የሥርዓተ ት/ት እና ኢንስትራክሽን ት/ት ክፍል

ለተማሪዎች የውይይት ቡድን የቀረበ ቃለመጠይቅ

ዓላማ፣ የዚህ የውይይት ቡድን ቃለ መጠይቅ ዋና ዓላማ መንግስታዊ ባልሆኑ 1ኛ ደረጃ ት/ቤቶች ውስጥ ያሉ የኢትዮጵያ ተማሪዎች ያላቸውን ኮምፒተሮችን ተጠቅሞ የመማር ተሞክሮ ለማጥናት ነው።

ተማሪዎቹ የሚመረጡት ት/ቤት ሥም

1. በትምህርት ቤታችሁ ኮምፒተሮችን ለምን ለምን ትምህርታዊ ተግባራት ትጠቀሙባቸዋለችሁ?

2. የትኞቹን የትም/ት ዓይነቶች ለመማር ነው ኮምፒተሮችን የምትጠቀሙባቸው?

3. ሥነተኛ ክፍል በነበራችሁበት ጊዜ ጀምሮ ነው ኮምፒዩተሮችን ለትምህርታዊ ተግባር መጠቀም የጀመራችሁ ?

4. ኮምፒዩተሮችን ተጠቅሞ መማርን ኮምፒዩተርን ሳይጠቀሙ ከመማር እንዴት ታወዳድሩላችሁ ወይም ትገልጹታላችሁ?

5. በኮምፒዩተር አማካይነት የሚቀርቡላችሁ የትምህርት ይዘቶች ምን ያህል ጠቃሚ ናቸው ብላችሁ ታስባላችሁ ?

6. በት/ቤታችሁ ውስጥ ባሉ ኮምፒዩተሮች ቢያንስ ባንደኛው ውስጥ የግላችሁ የፋይል ማቀፊያ / ጭቅሳስቄ/ አላችሁን ?

7. ኮምፒዩተሮች ተጠቅማችሁ ሥነ-ምግባር አዘውትራችሁ የምትጠቀሙት ቅደም ተከተል ምንድን ነው ?
