

CHAPTER 7

THE USE OF COMPUTERS TO TEACH COMPUTER EDUCATION INTERVIEWS WITH COMPUTER TEACHERS

7.1 Introduction

The main purpose of this chapter is to provide evidence on how teachers use computers in teaching and learning. It presents information collected from secondary schools in which computers are used to teach computer literacy skills. The data were obtained using semi-structured interviews with computer teachers. The sample consisted of twenty classroom teachers in Nyanza Province, Kenya. The data analysis combines qualitative and quantitative methods. Qualitative data analysis has been used for the interpretation of documents, discussions and interviews. The quantitative data analysis has been based on simple tabulation and graphical presentation (where possible) of teachers' responses to different issues. Qualitative analysis has also been employed because it enables more detailed views of the topic to be presented (Neuman, 1999; Yin, 1994).

The first part of the chapter addresses the participants' biographical information. This is followed by findings on the use of computers in teaching and learning. It includes the software used, why and how computers are employed in teaching students, and planning for teaching and learning with computers. The chapter then examines the integration and use of computers into teaching and learning traditional subjects. Particular attention is paid to patterns of use; teachers' knowledge of the computer technology; how students learn with computers; time allocated; value of using computers; the impact of computer technology; and the role of computers in the school. Problems and difficulties with the use of computers are also discussed. The last section deals with factors affecting the use of computers; teachers' views and attitudes towards the computer technology; teacher training in the use of computers; selection of software; suggestions for future improvement; and lastly, a summary of the main points.

7.2 Background information about teachers who participated in the investigation

As reported in Chapter 4 Section 4.6.1, the original plan for this study was to interview computer teachers in 30 schools with computers out of a total of 524 secondary schools according to the list of schools I received from the Provincial Director of Education (PDE) in Nyanza Province. However, after visiting each of the 30 public secondary schools, the researcher found only 20 of them teaching computer education and each school had only one computer teacher at the time of this research. Therefore, these 20 teachers were used as the source of data for this part of the study. The twenty interviews were tape-recorded and the recordings then transcribed. Employing unscheduled probes during the interviews as noted by Bell (1993), Yin (1994), Newman (1999), analysis of data began as data were first collected and continued throughout the study. The demographic data obtained from the participants were analyzed and are presented in the following sections.

7.2.1 Characteristics of schools from which the interviews were conducted

The field research was carried out in three different school settings. The fieldwork took place during the third term of 2001. Table 7.1 shows the type of schools by areas as described by the researcher.

Table 7.1: Types of secondary schools by location in which the interviews were conducted

School Type	Rural Area	Urban Area	Suburban	Total	%
Girls Schools	6	1	1	8	40%
Boys Schools	7	2	2	11	55%
Mixed School	1	0	0	1	5%
Total	14	3	3	20	100%

Table 7.1, displays the number of schools in which I conducted semi-structured interviews with computer teachers. All of the schools that participated in the investigation

were public institutions, sponsored by the parents and the government. However, there was one mixed secondary school catering for the students from the surrounding village and one urban Boys day school. There was no Girls day school. A comparison of study institutions indicated no difference in the number of girls and boys schools with computer teachers.

The respondents were 20 secondary school teachers teaching computer education in schools that had computers. The other five schools indicated in Chapter 6 Section 6.2 used computers for administrative work only and did not have computer teachers. For example, one of the Girls secondary school in a rural area had 31 teachers but only one of them was a computer teacher. However, the data collected indicated that 14 of 20 (70%) computer teachers were from rural schools, while 3 (15%) were from urban and another 3 of 20 (15%) were from suburban schools. The majority of computer teachers 17 were male and 3 were female. Only 1 of female teachers were from urban area compared to 10% of females from rural area. There was no female respondent from a suburban area. Similarly, 12 of male respondents were from rural area, and 2 were from an urban area. Suburban schools had 3 of the male respondents. From my experience, the gender and area distribution of the participants in this study is typical of secondary schools in Nyanza Province. There are very few urban centers so most of the public secondary schools are in rural areas.

7.2.2. Age and gender distribution of computer teachers

All of the teachers who took part in the interview were asked to state their age range. It was felt that age might be important in explaining or influencing teachers' interest in the use of computers. In Table 7.2 the total number of participants according to age and gender is displayed.

Table 7. 2: Age (Years) and gender distribution of the interviewees

Years	Teachers	Male	Female	Total	%
20-30	9	7	2	9	45%
31-40	10	10	0	10	50%
41-50	1	0	1	1	5%
Total	20	17	3	20	100%

Table 7.2 shows that of the 20 teachers who were interviewed, the majority (50%) was between 31-40 years. In the age bracket 41-50 there was only one female teacher. From my experience in Kenya, most female teachers do not stay long in service due to family commitments so they tend to retire early. The Principal of one school in the study reported that two of the women teachers who were usually very keen to teach computer education were on maternity leave. Table 7.2 shows also that overall there were more male participants than female. Out of 20 interviewees, seventeen (85%) were male and three (15%) were female. However, the issue of gender differences (especially few female teachers) reported in this section was a subject of detailed analysis in Chapter 6. For example, one of the girls' schools reported having 8 female teachers and 16 male teachers and another boys school had 30 female and 70 male teachers. Gender disparities in the teaching profession could be attributed to girl-child school drop out in Kenya that results in insufficient female students joining teacher-training institutions in Kenya. The Principals also reported gender disparity among the teachers in the schools investigated as noted in Chapter 6 Section 6.3 Table 6.5.

7.2.3 Academic qualification of teachers who took part in the investigation

Academic qualifications were part of the background information sought from the respondents. This was important because the teachers' ability to integrate computers into the subjects they teach is probably influenced by their level of education and teacher training as well as their training in the use of computers. The interviewees were asked about the highest academic/professional qualification they had. The result indicated that the majority of teachers 17 of 20 (85%) had attained university education but three

teachers had a diploma that is also a qualification accepted for joining teaching at secondary level. There was only one teacher with a Masters degree. None of the interviewees had a PhD degree.

Among teachers who participated in the interviews 13 were trained teachers, had teaching certificates and had a Diploma certificate in computer literacy. Out of the 13 trained teachers, 10 had Bachelor of Education (BEd) degree teaching certificate but 7 of them had a Diploma teaching certificate. The BEd graduates are trained to teach in secondary schools and teacher training colleges. The Diploma teachers are trained to teach specific subjects such as mathematics, sciences and languages at secondary school level. This is the second grade awarded to those who train to teach in secondary schools. There were also seven untrained graduate teachers who had B.A and BSc degrees. The untrained graduate teachers were employed to teach subjects such as Mathematics and Science in some of the schools that experienced a serious shortage of trained teachers in those subjects. These teachers also had a diploma qualification in computer technology and were employed to teach computer education as well.

7.2.4 Number of students taught by computer teachers

The participants were asked to state the number of students they teach per class. This was important information because of the facilities available for teaching and learning with computers. Table 7.3 gives a summary of this.

Table 7.3: Total number of students in computer classes

Level	Total Number of students	Average per class
Form I	950	48
Form II	616	31
Form III	470	24
Form IV	420	21
Total	2,456	31

As can be seen from Table 7.3, in Form 1 a total of 950 students (ages between 13-15 years) were taught by 20 teachers which means that an average of 48 students were taught by each computer teacher, while Form II had the second highest number of student 616 (ages 15-16 years). The reason being that in 14 of 20 institutions that were investigated computer education was compulsory for all students in these two forms. However, in Form III, the subject was an elective and offered only to those students who chose to proceed with it to Form IV. At Form Four level the number decreases because it is offered to those registered for the national examination. This is due to the fact that computer education is classified as a Technical and Applied subject and students are free to decide on which subjects in the group to register for in the Kenya Certificate of Secondary Education (KCSE).

In addition, the interviewees were asked to indicate the classes in which they currently teach computer education. Table 7.4 displays the findings.

Table 7.4 Computer classes taught by the interviewees in study schools

Classes	Female teachers	Male teachers	Total	%
Form 1 only	0	2	2	10%
Form 1-2	1	1	2	10%
Form 1,2,3	0	3	3	15%
Form 1&3	0	4	4	20%
Form 3 only	1	2	3	15%
Form 4 only	1	0	1	5%
Form 1-4	0	5	5	25%
Total	3	17	20	100%

As table 7.4 shows, 5 of 20 (25%) participants taught computer education in all Forms. The other teachers taught computer education in one, two or three Forms. However, there was one teacher who taught computer in form four only. In addition to teaching Computer Education, the teachers also taught other subjects such as indicated in the following Table 7.5.

Table 7.5: Other subjects taught by computer teachers in study schools

Subjects	Number of Teachers	Percentages
Mathematics/Science	11	55%
English/Literature	5	25%
Accounting/Business/Geography	4	20%
Total	20	100%

From the above Table 7.5 it can be seen that most of the computer teachers were mathematics and science teachers. The finding also supports the information contained in Section 7.2.3 regarding the untrained graduate mathematics and science teachers.

7.2.5 Teachers' years of teaching experience

Experience on the job can help teachers to relate to new situations, to solve classroom problems (such as students' discipline during computer classes) and to help them find practical approaches to learning. Experience enables the teacher to draw upon professional insights and skills, which includes sensitivity to the specific interest, needs and abilities of the students. Therefore, interviewees were asked to indicate their experience in teaching. This was important information because lack of experience in teaching normally interferes with teachers' confidence and professional competency. This happens mostly when a newly appointed teacher is assigned to teach the subjects they are not particularly conversant enough to teach. Table 7.6 demonstrates the position of teachers in relation to the years of service in teaching.

Table 7.6: Teachers' Experience in teaching and classes taught

No of Years	Rural	Urban	Suburban	Total
0-1	2	0	1	3
2-5	5	1	1	7
6-10	5	1	0	6
11-20	2	1	1	4
Total	14	3	3	20

The above analysis displays the participants' years of teaching experience by location. When looking at the distribution of participants' length of service from rural, urban and suburban schools, the finding indicates that there were more rural teachers than urban or suburban teacher but proportionally the urban teachers were the most experienced. Under the number of years >10 there were 33% urban teachers with experience and only 14% of rural teachers in this category, while there were 66% of urban teachers with >5 years of experience compared to only 50% in this category. From my experience, in general, the years of service of teachers in the teaching profession in Kenya range from thirty to thirty five years. However, the difference in experiences of teachers according to location in Nyanza province could be due to frequent transfer of teachers to other regions. The small number of years of service of most teachers could be due to teachers leaving the profession to join other jobs for better payment.

7.2.6 Teachers' length of service in teaching and learning with computers

Teachers in the study were asked to indicate their experience in the use of computers in teaching and learning. This was regarded as essential because the issue of teachers' ability to handle computer education was a vital factor in the implementation and use of computers in teaching and learning that was reported by (Njagi, 1997:25). Table 7.7 displays the finding as reported by the participants.

Table 7.7: Teachers years of experience with computers by location of schools

No of years	Rural	Urban	Suburban	Total
0-1	6	0	1	7
2-5	4	1	1	6
6-10	4	2	1	7
Total	14	3	3	20

Prior computing experience reported by the 20 teachers who participated in the investigation varied as shown in Table 7.7. 35% of the teachers had less than one year experience in teaching with computers, while 30% had between 2-5 years and 35% had

less than ten years experience with the use of computers. There was no teacher with more than seven years experience in teaching computer education. This is due to the fact that the government policy guideline discussed in Chapter 5 was formulated in 1996 and some schools introduced computer education in the same year. This is also in contrast with teachers in developed countries like America and Britain where most of the teachers have many years of experience with use of computers in teaching and learning (Kirkman, 2000; Rudd, 2001; Russell, 2000).

7.2.7 Participants' rating of experience with computers in teaching and learning

Teachers who took part in the interview were asked to rate their experience with use of computers in teaching and learning by providing answers to closed questions on their experience with computers. Table 7.8 shows their responses.

Table 7.8: Teachers' rating of experience with use of computers

Rating	Rural teachers	Urban teachers	Suburban teachers	%
Some experience	8	1	2	55%
A lot of experience	6	2	1	45%
Total	14	3	3	100%

From the above Table 7.8 it can be seen that there was no computer teacher without the knowledge of computer skills, although (45%) of them had a lot of experience with the use of computers than the rest of them. Abas (1995) and Vannatta and Beyerbach (2000) report similar findings from developed and developing countries as discussed in Chapter 2.

7.2.8 Types of software packages used by the computer teachers in schools

Another important area of investigation was the availability of computer software in schools and the types of software that teachers used in teaching computer education. This question was asked because it was necessary to get information about what the schools

have in order to compare this with the kinds of software suggested in the computer syllabus. The responses from the interviewees are shown in Table 7.9

Table 7.9: Types of software packages used by teachers in study schools

Software	Number of teachers	Percentage
MS office packages	20	100%
Lotus 1,2,3,	4	20%
MS Dos	4	20%
Publisher	3	15%
Accounting	2	10%
Other packages	7	35%

From the above Table 7.9, it is clear that all the interviewees reported using Microsoft office packages for teaching and learning. In addition, other packages such as Page Maker, Pascal, Print Artist, Keyboard Skills, Note Pad etc, were mentioned by seven of 20 (35%) participants as being used in their schools. These programs were considered by the teachers to be important to the school because the whole school used them for information storage and retrieval of staff records, salary preparation, students' registration records and examinations results analysis. Teachers also used the programs in teaching specific skills such as word processing and in improving the teaching of accounts and commerce subjects. The software packages named by the teachers were the same as those in the Secondary Computer Syllabus except for Page Maker and Print Artist. Similar computer application programs are contained in Draft National Curriculum Statement Computing (2002) from the Department of Education used by teachers in South Africa to teach students (Grades 10-12) Information Technology, that include also Desktop publishing, Web-page, e-mail and Internet.

7.2.9 The role of computers in the school that participated in the investigation

Teachers were asked to state clearly what they considered to be the major role of computers in their school. This question was asked because teachers' views about the

major role of computers in schools were regarded as having a big influence on their attitude towards using computers. A summary of the responses from the participants is displayed in Table 7.10.

Table 7.10: The role of computers in schools that participated in the investigation

Responses	Participants	%
Educating students, teachers and community	4	20%
Teaching students computing skills	10	50%
Administrative duties, storing students marks	4	20%
Improve teaching of other subjects	2	10%
Total	20	100%

Most of the teachers believed that the major role of computers was in teaching students computer literacy skills (as suggested in the syllabus). Some of them saw the role of computers as that of creating computer awareness among the school population and the community. However a group of them also noted the role of computers as that of administration, office work, used for correspondences, storing of information, setting of examinations, recording students marks and records. A few teachers reported that computers also improve the teaching of curriculum subjects by providing reference materials and remedial work.

7.3 Teachers report on the use of computers in teaching and learning in the class

The main purpose of this investigation using semi-structured interview was to provide evidence regarding the use of computers in teaching and learning in schools in Nyanza Province, and to identify the extent to which computer programs were actually being used in the classrooms. Therefore, in interviews with computer teachers, the participants were asked to provide information about whether they used computers in teaching and learning in the classroom, and who encouraged them to teach Computer Education? In response to the first question, all the interviewees reported that they were using computers in teaching and learning in their schools. However, in response to the second question about who encouraged them to teach computer subject their reply were as indicated in Table 7.10.

Table 7.11: Response from teachers regarding being encouraged to teach computer

Education		
Ratings	Frequency	Percentages
Highly encouraged	14	50%
Partly encouraged	4	30%
Not encouraged	2	10%
Total	20	100%

From Table 7.11 it can be seen that the majority of the interviewees (60%) were encouraged by the Principals to teach computer education (as in the official computer syllabus). The findings were very encouraging because a study by Yee (2000:287-301) revealed that teachers need support from the administration in order to use computers effectively. However, 30% of the interviewees indicated that they received partial support from the Principal and were motivated to use computers. But 10% of them said they were not encouraged by the school administration to teach computers. They argued that it was their own interest that led them to teach the subject. The overall findings showed that all the teachers used computers to teach computer education and to store and analyze students' marks. Furthermore, during the discussion with the interviewees, none of them indicated that they were encouraged to use computers as part of teaching other subjects. Some of the teachers who integrated their subject topics into computer programs reported that they did so on their own and were adventurous. They also indicated that through interactions with other teachers from other schools in Kenya they were informed of the availability of computer software for various subjects which some of them obtained for integrating into subjects like science and mathematics. There is need for all teachers to be encouraged and supported by the administration in order to integrate and use computers in teaching and learning.

7.3.1 Why teachers use computers in teaching and learning

Similarly, the interviewees were asked to explain why they use computers in teaching and learning? This question was a very useful one, because teachers need to have a specific

reason for using computers as a tool for teaching and learning. The question yielded a wide variety of answers that are summarized and presented in Table 7.12

Table 7.12: Why do you use computers in teaching and learning?

Summary Points

To teach computer literacy skills: word processing, spreadsheet, database management, programming etc.

Preparing learning materials such as teachers' lesson notes, students' handouts, and examination materials.

Learning, especially from the Internet educational materials on subjects like Biology, Mathematics, and History etc.

To improve the quality of teaching and learning by using the materials not easily available to the teacher.

To prepare students for major economic and social challenges likely to be met after schooling.

To teach students computer science-hardware and software.

To process students results, eg. Ranking of students, assigning grades, analysis of performance index for class and overall performance index.

Computers have high storage and retrieval capacity, it is faster, accurate, convenience, not bulky compared to traditional way of filing so students learn to keep their work in an organized manner.

To motivate students to learn on their own the subjects available in computer programs and to relate such knowledge to curriculum subjects.

In addition, the participants reported that computers are very useful in helping students to master statistics that is covered in mathematics. One of the interviewees reported that *"once they (students) have done statistics in mathematics lesson, they come and process the same information in the computer."* Another one said, it is very useful in teaching English language, especially in *"spelling checking and grammar."* In teaching accounting, the interviewees noted that *"spreadsheets are the same ones used in solving mathematical skills"* Lastly, some participants reported that they used computers for supplementary work outside the curriculum area. Table 7.12 displays the analysis of their responses.

Table 7.13: Teachers' use of computers in teaching and learning

Pattern of use	Teachers	%
Teaching computer literacy skills: word processing, spreadsheet, database, graphic, programming etc.	20	100%
Teaching traditional subjects: Mathematics, Sciences, Languages, Technical etc.	8	40%
Getting new ideas for curriculum subjects like statistics, languages etc.	4	20%
Motivating students to learn on their own.	2	10%
Keeping school records: students examination marks and grade analysis	2	10%
Improving learners' communication skills	4	20%

Table 7.13 shows that all the participants used computers to teach the skills contained in the Secondary Computer Syllabus. However, in other learning areas, the analysis indicated that many teachers used computers for teaching and learning traditional subjects like mathematics and sciences. This finding supported a similar study by Azita (1999) on the use of computers to teach mathematics reported in Chapter 2. However, other teachers also reported using computers for getting new ideas in subject areas not easily available in their textbooks. At the same time, some of the teachers reported that computers were very useful in motivating students to learn on their own. The computer is usually regarded as being accurate and fast with storage and retrieval of information. This point was reported by 2 of the interviewees while four of them used computers to improve students' communication skills. However, findings from this study have provided valuable information indicating how few teachers were making effective use of computers beyond what the syllabus intended. Carol (1997), Ertmer et al. (1999) and Simmt, (1997) reported similar findings from developed countries, and Bitner and Bitner (2002) support the use of computers to motivate students to learn.

7.3.2 How teachers use computers in the schools that participated in the study

One of the purposes of this study discussed in Chapter 1 Section 1.9 was to investigate how teachers use computers. So question two of section B sought answers from the interviewees in relation to how computers were employed in teaching and learning. This was an important area of research because computers were introduced in Kenyan public secondary schools to teach computer literacy skills and there was a need to provide evidence if this was happening in the schools that participated in the investigation. The responses were summarized and indicated in Table 7.14.

Table 7.14: How teachers use computers in teaching and learning

Responses	Participants	Percentages
As a tool/teaching aid	11	55%
For generating of ideas for class work	4	20%
Teachers use it for lesson planning	3	15%
Teaching main part of the lesson	2	10%

Table 7.14 indicates that teachers used computers as a tool/teaching aid to teach computer literacy skills, but some of them used computers for supplementary work. This involved integrating part of the traditional subject topics into computer programs. Teachers reported using computers to introduce a topic, to reinforce a concept or to revise what students have learnt in the class (for example in grammar and spelling, composition, comprehension in English language). Other teachers employed the computer for generating new ideas for teaching their curriculum subjects. However, a few of the interviewees reported using computers for teaching the main part of the lesson, such as when they use it to demonstrate how things are done. For example, in learning word processing they show students how to use computer technology to process information.

7.3.3 Teachers' preparation to teach with computers

The interviewees were asked to state if they prepare for teaching and learning with computers, and whether they have schemes of work and lesson plans. It was necessary to obtain the information on this issue because every teacher is supposed to have a lesson plan and a scheme of work for all the subjects they teach. A scheme of work is a plan derived from the prescribed syllabus for a particular level of education. All teachers must prepare their schemes of work showing how much of the syllabus will be covered within a given period (usually one school term or two terms). The response from the interviewees on this question indicated that the majority of them (80%) prepared for teaching with computers, and 60% had schemes of work, but another 60% of them reported having lesson plans. Similarly, 75% reported using general notes for teaching and did not have lesson plans. Overall, the interviewee noted that the use of computers enabled them to produce neatly written lesson plans and notes that they filed and stored on diskettes for further improvement as needs arise. Table 7.15 provides visual displays of the responses from the participants.

Table 7.15: Planning for teaching with computers

Responses	Participants	Percentages
General preparation	16	80%
Schemes of work	12	60%
Lesson plan	12	60%
General notes	15	75%

Planning for teaching is an important element in teacher preparation. As indicated in Table 7.15, teachers need to prepare in advanced all of the units listed in the above table before using computers in teaching and learning. A good lesson plan will enable teachers to teach students computer skills effectively. If they do not plan properly they might find that the students they teach are more knowledgeable in certain computer skills than the teachers. Therefore, planning to use a computer program in teaching requires teachers to research and prepare relevant materials for lesson presentation orally or practically.

7.3.4 Pattern of using computers in teaching and learning

McCoy (1996) noted that computers have been used for drill and practice, for enrichment, for supplementing the curriculum and as a tutor. In this connection, I asked the interviewees to explain if they used the computer in any of these ways. It was necessary to establish whether each teacher had a particular pattern of using computers, and if all of them employed similar usage. Their responses are summarized in Table 7.16.

Table 7.16: Pattern of using computers in teaching and learning

Pattern of use	Yes	No	Total
Drill and Practice	14	6	20
Enrichment	9	11	20
As a tutor to assist teachers	7	13	20
For supplementing curriculum	7	13	20
To facilitate learning	4	16	20
For remedial work	4	16	20

As indicated in table 7.16 the majority of the teachers used computers for drill and practice. During the interview, teachers indicated that after teaching the students a skill, they do practice on their own. One of the teachers reported that *“Yes I drill them especially for them to be acquainted with the use of keyboard for faster typing of text, and also to know where different keys and groups of keys are.”* Another one reported *“you see in form one, I have 21 students, when learning in class, three students share a machine. During practice session, only one student use the machine at a time”* Still another teacher reported that *“after learning in a group, I drill them to compose letters and stories which improves their writing skills.”* There were also some of them who did not use computers for this purpose. When the interviewees were asked to state the reasons why, one of them reported that *“with computers students learn better with drill and practice. They practice on their own after demonstrating to them.”*

Another group of teachers reported using computers for enrichment because the computer provides a variety of learning resources that cut across all traditional subjects students learn in the school. In another response to enrichment, one of interviewees explained that *“I prepare and use the chart to illustrate the points then use the computer.”* Another one reported that *“once the students have done statistics in mathematics they come and work on the computer to solve the same problem.”* Moreover, the other teachers also reported using computers as a tutor. In this usage, teachers indicated that sometimes they prepare some work in the computer for students to learn on their own. At the same time other teachers used computers for supplementary work. They stated that some times they use the computer to access extra information to add to what they teach in the traditional subjects such as science and social studies. The interviewees noted that computer programs could make the learning process easy for students since they learn by doing. Some teachers used computers for remedial work by enabling slow learners to revise the assignments and to access information at their own pace.

7.3.5 Software used by the students in schools that participated in the investigation

The other area of computer use considered was the specific software and applications that were being used by students. The responses from the participants are summarized in Table 7.17

Table 7.17: Software that students learn in study schools

Items	Participants	Percentages
Word processing	20	100%
Spreadsheet	15	85%
Database	14	70%
Graphics	8	40%
Programming	6	30%
Others	7	35%

The findings displayed in Table 7.17 are similar to the one in Table 7.9. But in this question, the interviewees were asked to list specifically the software programs used in teaching students computer literacy skills and not the software available in the school.

Therefore, from the above Table 7.17 it is evident that all the interviewees reported that the students used word processors. This is because word-processing packages are by far the most common application of information technology used in schools in developed and developing countries. Furthermore, word-processing is concerned mainly with the manipulation of information both textual and graphics. It allows students to process information and this is an activity that is at the heart of learning. It is also useful for input, editing, correcting work and presenting text of any kind (Robinson, Bloomfield and Carson 1994). In addition, 85% of the interviewees reported using spreadsheets citing the importance of spreadsheets as a useful tool for improving mathematical operations and accounting. The result of this study supports the findings of Cavendish and Waters (1994:102-107) who noted that a spreadsheet is a tool that can support any activity that involves numerical calculations. They also report that the “most valuable features of spreadsheet is that once the data has been entered into the cells, arithmetic operations can be carried out on whole rows or columns of numbers.” Thus allowing learners to explore patterns and relationships that cannot easily be investigated without using a computer.

Furthermore, 70% of the teachers reported their students use a database program. The interviewees noted that database programs allow students to collect and organize data and feel ownership over the data. Underwood, Dickinson, Lee and Lynch (1994) also supported the use of databases in schools arguing that thinking skills are encouraged by the use of a data storage and retrieval system. The other software presented in Table 7.17 above is the graphics reported by 40% of the participants, programming reported by 30%, and other computer programs reported 35% because of their usefulness to particular groups of learners.

7.3.6 Reasons for integration and use of computers in teaching and learning

Previous studies carried out in developed countries (Myhre, 1998; Ertmer et al. 1999) have identified several reasons commonly given by teachers for their integration and use of computers. Some of these reasons can be summarized as follows:

- Important tool to bring a lot of changes in teaching and learning techniques;
- To improve subject matter teaching;
- Development of new knowledge, skills and concepts;
- To bring additional expertise and teaching ideas for teachers who lack experience or confidence in teaching certain areas of the curriculum;
- To present information in an interesting and stimulating way;
- To give access to experiences not easily provided by the teacher;
- To introduce, extend and reinforce areas of learning.

With the above reasons in mind, I asked the teachers in my study to supply the main reason for integrating computer technology into teaching specific topics in their subject area. Their responses are summarized in Table 7.18.

Table 7.18: Reasons for integration of computers by teachers

Reasons	Respondents	Percentage
Links with subject topics in class	4	20%
Well presented, interesting, stimulating	6	30%
Well researched information on various topics	5	25%
Covers subjects not available in class	2	10%
Children enjoy, they learn new ideas	3	15%
Total	20	100%

The main reason that encouraged teachers to integrate computer technology into teaching subjects was that teachers felt computer programs were well researched, well presented and formed links with traditional subjects as reported by 75% of the interviewees. Thus,

it is important from the teacher's point of view that computer lessons need to be well researched, and designed to link to the course work.

7.3.7 Students' knowledge of computer literacy skills

The computer is a technology that cannot be used unless one has some skills to operate it. Teachers who took part in the interview were asked to state their students' knowledge of computer literacy skills by indicating whether their students had basic, average or advanced skills. The results indicated that 40% of the teachers reported that their students had basic knowledge of computer literacy skills. The students were able to operate the machine on their own, use the mouse, keyboard, access files, processing their work and print. However, 40% of the teachers reported that their students had average computer skills and were capable of using a word processor to compose stories, edit, and retrieve files. But the students with advanced computer literacy skills reported by 20% of the interviewees were able to use all the software tools such as word processor, spreadsheets, databases and basic programming. The current research did not attempt to gather evidence directly from students to verify the teachers' claims about the computer skills of their students. This is an issue that would need to be investigated further to verify that the objectives of the Secondary Computer Syllabus were being achieved.

7.3.8 Classroom teachers' level of computer literacy skills

The computer teachers were also asked to state their level of computer literacy. This question was asked in order to assess teachers' knowledge of computers because as teachers of computer education their level of computer knowledge should be above that of the students they teach. The findings were analyzed and presented in Table 7.19

Table 7.19: Computer teachers' level of computer literacy skills

Responses	Male	Female	Total	%
Advanced level	13	1	14	70%
Average level	4	1	5	25%
Basic level	0	1	1	5%
Total	17	3	20	100%

From the above table 7.19, it is apparent that the majority of the interviewees considered themselves to have advanced level of computer literacy skills. This group also felt competent enough to handle computer programs since they trained in the Advanced Information Technology course and obtained a Diploma. The interviewees who were in the category of “average” had also attended a computer literacy course and obtained an Advanced Certificate. Only one of the interviewees had no training in computer literacy but reported having studied some computers in an undergraduate programme and felt capable of assisting students temporarily.

Some important implications from this research were noted. Firstly the study provided strong indications that the implementation of computer education requires teachers who are adequately trained and competent to impart knowledge to learners. Secondly, the finding compares favorably with that of Gobbo and Girardi (2001:68) whose studies in Italian schools indicating that frequent utilization of computers tended to vary with the level of competence of the teachers. While talking about competency, Fraser (2001:68) emphasized that “occupational functions and accompanying performances requires competent practitioners whose skills and expertise are vested within the defined tasks and functions of a profession.” Hence computer teachers need to be competent to teach computing applications contained in the Secondary Computer Syllabus. Therefore, there is need for effective teacher training of teachers in the use of computers in teaching and learning.

7.4 How students learn with computers

Many scholars (Heinich, Molanda, Russell and Smaldino, 2002; Gibson, 2001; and Tiene and Ingram, 2001) believe that computers are extremely important because they can encourage students to learn on their own, and to discover new information, ideas and materials useful for learning their subjects areas. In particular, Berson (1996:486) reports that computers can enhance academic learning by improving the effectiveness of instruction by:

- providing immediate feedback to the learner;
- allowing for instruction at individualized pace with specialized modification to promote mastery learning;
- incorporating interactive exercises;
- facilitating cooperative learning to enhance higher order thinking skills; and
- allowing for drills and practice to promote whole class activity.

Consequently, with the above points in mind the interviewees were asked to state how their students learn with computers. All the teachers interviewed reported that their students learnt with computers in small groups. When asked to give reasons why the students learn in small groups, one of the participants replied that *“learners are action based so they do not enjoy so much theory and while in groups they consult one another.”* 50% teachers reported that their students learnt with computers individually when they are given assignments, during practice or when doing examination. In addition, 75% of the interviewees noted that students learnt with computers as a whole class in addition to individual and group work. One teacher remarked *“when I am teaching theory, introducing the students to the working of the machine and types of software I lecture to the whole class.”* Another teacher from a school in rural area reported that *“although I allow the students to use computers individually, I must be present to assist them and guard against those who just play cards or smuggle their diskettes with viruses.”* Still another teacher remarked *“Sometimes I give directions and help learners one by one with using computers to compose stories.”* From this it seems

that the teachers recognized the need to vary their methods of using computers to meet the needs of the students and the demands of what they were teaching.

7.4.1 Number of times teachers use computers per week

Computer teachers were asked to state how often they used computers by indicating the number of periods per week. This question was asked in relation to the previous research findings by Carol (1997) that teachers had no time to plan and use computers in teaching and learning. The results of my study indicated that the amount of time for using computers in the study schools varied greatly. There were those who reported using computers once a week and others used them twice, thrice, four times, five and even over five periods per week. Similar response was also obtained from the Principals and Heads of Department investigation reported in Chapter 6 Section 6.7.6.2. Table 7.20 shows a very high degree of usage among the interviewees.

Table 7.20: How often do you use computers in teaching and learning?

Number of periods	Responses	Percentage
Once a week	1	5%
Twice a week	4	20%
Thrice a week	1	5%
Four times a week	5	25%
Five times a week	1	5%
More than five times	8	40%

As demonstrated in Table 7.20, it is quite clear that computers have an important place in teaching and learning in the study schools. The above Table 7.20 indicates that the majority of respondents (70%) who participated in the investigation claimed that they used computers at least four times a week in the sample of schools. The Secondary Computer Syllabus recommends four periods for Forms 1 and 2, and 5 periods for Forms 3 and 4 periods per week. However, some teachers reported using computers more than five periods per week. For example one of the interviewees said that “*students are so*

much interested in computer education that apart from the time allocated in the school time table, we are allowed to have extra classes in the evening and during week-ends, so we end-up having more than eight periods per week.”

7.4.2 Integration of computers into teaching subject topics

Another objective of this study was to investigate whether teachers were integrating computers into teaching subject areas such as science. Each of the interviewees was asked to state the level of integrating technology into teaching and learning. The findings indicated that most of them had not integrated computers into their general teaching and learning processes but one of them responded *“If I am using computer during literacy classes I may make reference to the topic in my subject then the students look at it in the computer.”* Some of the interviewees reported also that they inform the students about the program containing information relevant to a topic in a subject like mathematics, *“then they look for the information in the computer to learn about it.”* Still another teacher reported *“ I use the computer to summarize what I have taught by showing some skills in different subjects e.g. sciences and history.”* Table 7.21 gives a summary of the interviewee’s responses.

Table 7.21: How teachers integrate computers into subject teaching

Response from teachers	Number of teachers	Percentages
Use as main lesson	2	10%
Use as part of the lesson	2	10%
Use it for introduction	3	15%
Use it for summary	4	20%
No integration	9	45%
Total	20	100%

The findings in Table 7.21 support an earlier study by Liu, Macmillan and Timmons (1998) stating that integrating computers into the classroom has to take teachers personal and professional constraints into consideration. Most of the teachers interviewed had not

been exposed enough to computers to be able to integrate them into teaching and learning. A similar finding by Ertmer et al. (1999) indicated that full integration of computers into the educational system was a distant goal unless teachers are trained, competent and are willing to use computers in teaching and learning traditional subjects. Myhre (1998) also believed that the teachers' use of computer technology could vary tremendously depending on the teachers' experiences, knowledge and beliefs.

7.4.3 Value of using computers in teaching and learning

The other area of investigation was to establish whether computers were really valuable to secondary school teachers. The interviewees in the study were asked to state the degree to which computer programs were valuable to them by giving a categorical rating of their responses as highly valuable, very valuable, valuable or not valuable. The findings are in Figure 7.1

Figure 7.1: Value of using computers in teaching and learning

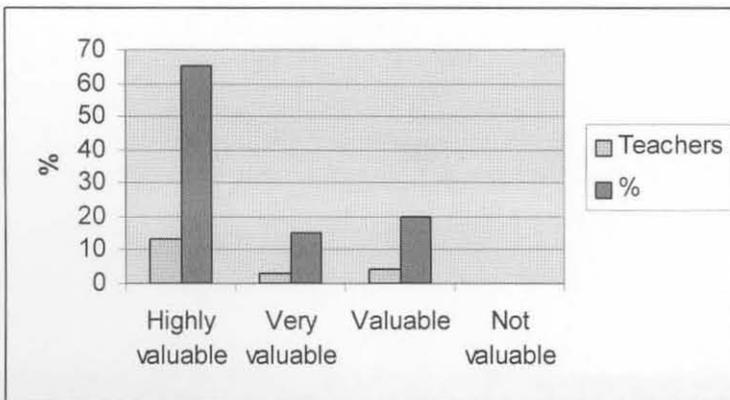


Figure 7.1 indicate that 13 of 20 (65%) of the teachers interviewed regarded computers as highly valuable compared to 3 of 20 (15%) who believed that computer was very valuable. Only 4 of 20 (20%) reported that it was valuable. None of the interviewees found the computer technology worthless. They all agreed that students and teachers learn a lot from computers. However, when the teachers' responses were analyzed by area the pattern was different. Table 7.22 shows the findings by area.

Table 7.22 Teachers' rating of Computer Education by location of the school

Ratings	Rural	Urban	Suburban	Total	%
Highly valuable	0	2	1	3	15%
Very valuable	12	1	1	14	70%
Valuable	2	0	1	3	15%
Not valuable	0	0	0	0	0
Total	14	3	3	20	100%

Table 7.22 shows the responses from teachers from rural, urban and suburban areas regarding the value of computers in teaching and learning. There was no teacher from a rural area who rated computers as highly valuable and none of the teachers rated it not useful. When the interviewees were asked to state the reasons for their ratings, one of them commended the use of computer technology *“especially in productivity, the way the files are kept is exemplary, due to easy access to them, alterations are very easy too.”* Another one reported that *“the computer makes work easier i.e. much better than a typewriter or a calculator.”* However, the overall rating of computers in teaching and learning by the participants was that they were very valuable as can be seen from the above Table 7.22.

7.4.4 Benefits of using computers in teaching and learning

Teachers were asked to give their views on the main benefits of using computers for teaching and learning by students and teachers. This relates to some questions regarding reasons for using computers, but here the participants were asked to give their views on the benefits. The most common answers were summarized and presented in the following Table 7.23

Table 7.23: Benefits of using computers in teaching and learning

Benefits of computers in teaching and learning

Explaining and illustrating difficult scientific and mathematical concepts e.g. statistics.

Demonstrating scientific experiments that are difficult to conduct in the class without such aids.

Supplementing teachers' and students' knowledge of some subject topics.

Widening students' scope of knowledge and enabling access to various fields of learning

Computer programs incorporate the best and most up to date information indifferent subject areas, and the content is presented in an organized and stimulating format. Students learn a lot from the Encyclopaedia.

It creates computer awareness and facilitates students' work in class, especially in practical work thereby providing secretarial training as well.

It exposes students to better employment opportunities in future by helping them to get basic literacy skills required for such jobs.

When used as an instructor, it is very consistent and presents the lessons at the learners' pace.

Course materials can be stored and retrieved for future reference.

It allows updating and editing of documents so changes can be easily done without wasting time.

It is faster, accurate, saves time and improves thinking skills.

It is motivating, encouraging and makes one eager to learn.

Provides good filing system by making easy access to files as opposed to the traditional bulky filing system.

Processing and printing neat, attractive and orderly work.

It helps to make learning student based, more friendly and easy to follow.

It helps to generate ideas as students learn with computers

The above benefits indicate a high degree of agreement between all the interviewees who participated in the investigation about the benefits of using computers by teachers and students. The other response, by both female and male participants, was that the use of computers enabled them to access new ideas. Another of the benefits identified by teachers was that using computer enabled them to give students experiences that would be difficult to provide in any other way. Such experience enables students to improve their understanding, for example, by solving mathematical and scientific problems on their own.

7.4.5 Limitations of computers as a tool for teaching and learning

As well as identifying benefits of using computers, teachers were also asked to respond to the question “Are there any limitations of computers as a tool for teaching and learning?” This question was important because computer technology like any other tool for teaching and learning could have limitations to users in different parts of the world. So the question was asked in order for teachers in the study to report disadvantages of using computers in their schools. The most common types of responses to this question were summarized and presented the following Table 7.24.

Table 7.24: Limitations of computers in teaching and learning

Limitations of computers in teaching/learning

Cost of the hardware, software and manpower that many schools cannot afford.

It depends on constant supply of electricity, and when there is power breakdown it cannot be used.

Sometimes programs like windows give problems with responses. Students who are eager to learn do not get it. MS DOS is not as highly responsive and gives learners time. But in Windows if you make a small mistake the whole program goes.

Computer does not take care of individual differences of students compared to the teacher. Some students have problems with poor eyesight.

It needs special room free from dust, humidity, and care must be taken of all computing materials.

It cannot revisit a problem, although it can take a learner step by step. But when the students use computers, there is a limit to a detailed explanation of what the students need in order to understand a concept, or other teaching aids or relates a topic to past experiences or with what happens to learners in any situation.

Computers are very delicate machines, can easily break down so care must be taken to handle them.

It requires training, one must have the skills to use the machine.

It is prone to theft and attack by virus.

As shown above, only a few limitations of computer as a teaching and learning aid were identified. One concern mentioned by some of the interviewees was that computers rely on a constant power supply, so the students cannot use the computers when there is no electricity. Another problem raised by many of the participants was that computers are

expensive. This could be due to a variety of factors such as: lack of funds, demand on time and lack of manpower. However, one of the interviewees reported that *“it is difficult to use four computers with a population of 50 students per class. So sometimes I create extra time for them to practice the skills. After teaching a topic in a subject I also ask students to access related information in the computer to reinforce what they have learnt. But it is a problem to use the computer technology as a teaching and learning resource in subjects because of different abilities of students within their teaching groups.”*

7.5 The impact of computers on students' learning

According to Underwood (1994:31) computer packages motivate students, encourage collaboration and social interaction and offer greater parity of access to learning the curriculum. In this connection, all of the teachers interviewed were asked to identify what they felt to be the main impact of computers on students' learning, and to state how the software packages they used contributed to students' learning. They were also asked to state whether they could think of specific examples when students' learning was stimulated or enhanced by computer programs. In response, the majority of the interviewees noted that students are motivated to learn when they use technology. One of teachers reported that *“there is no sleeping during computer class, a sign that they appreciate their use of computers and what they learn from them. It increases students' desire to learn. They are normally very happy and this enables them to learn even more on their subject area.”* Some of the interviewees were also able to identify the contribution of computers as indicated in Table 7.25 below.

Table 7.25: Impact of computers on students learning

Responses from teachers	Number of participants	%
Students recall what they learn	4	20%
Discuss with other students what they learn	3	15%
Improve students' communication skills	6	30%
Increases motivation and attention to learn	4	20%
Students learn new ideas	3	15%
Total	20	100%

From Table 7.25, it is evident that all the interviewees recognized the contribution computers can make to students' learning. For example, the interviewees reported that the use of computers in teaching and learning was very useful to students. The learners were able to recall what they have learnt, discuss with other students what they have learnt as well as obtaining new ideas. Some of the teachers also noted that the use of computers increases students' motivation to learn. As discussed in Chapter 3 Section 3.4.1, motivation is an important factor that has been identified by scholars to influence what students pay attention to, how long they pay attention and how much effort they invest in learning. According to Heinich et al. (2002:58) "students who are intrinsically motivated will work hard and learn more because of their personal interest in the materials." However, the discussion on the impact of computers on students' learning generated more topics for analysis as indicated in the following sections.

7.5.1 The impact of computers on students' learning of skills and concepts

Many teachers noted the impact of computer programs to enhance students' ability to learn by doing and concentration. Students learn literacy skills and subject-related concepts particularly in mathematics, sciences, languages, technical and humanities subjects. For example, one teacher from a rural school who teaches accounts described how the students worked on their balance sheet during computer lessons, and after the students resumed their traditional accounting class work, the teacher observed that the students had picked up some ideas from the computer program. A few teachers from

urban areas also found computer programs helpful in promoting students' questioning, discussion and reasoning by focusing on controversial issues in subject areas. For example, one teacher reported that since he started using computers "*some students have developed reasoning powers on issues like cultural practices, health issues i.e HIV/AIDS, they also asks questions on evolution of man etc.*"

In addition, the interviewees felt that computers offered particular benefits as a medium of instruction. Teachers who participated in the interview referred to the ability of word processors to improve students' communication skills, such a creative writing, spelling, grammar, and composing stories. They also commented on the ability of the computer technology to put a subject across to learners in a stimulating way through the use of strong visual images. Through their stimulating content and presentation, computers were felt to contribute to learning by enhancing attention, motivation and recall of what has been learnt. In addition to improving teachers' instruction, computers were found to be helpful in teaching students typing skills, developing their general awareness of computer literacy skills and assisting in the development of conceptual understanding.

7.5.2 Recall of what students have learnt

The computer application programs such as spreadsheets, databases, word processors, graphics etc, were the main computer programs that were used by the interviewees to teach students' computer literacy and to integrate computers into teaching and learning traditional subjects. For example, one teacher from a rural area stated that "*in spreadsheets there are mathematics and accounting functions, so the students find it easy to revise what we have covered in these subjects, and when they come across some new ideas they come and ask me. Moreover, I have observed that the students discuss among themselves what they learn from computer technology.*" Because students are exited during computer classes, teachers believed that they learn from the use of computer programs such as word processors.

The comments that teachers made about computers helping students to learn and to recall information were based on the general impression that the teachers gained while using computers in their classes. None of the teachers had attempted to verify these impressions in any formal way such as through research.

7.5.3 Students' attention and interest to learn

Teachers in the study noted that students were keen and interested during computer classes. As one of the interviewees reported that *"once the students are in the computer classroom they do not want to stop working unless they are forced to leave."* The interviewees also noted that *"the computer is particularly successful in stimulating students to attend to the information contained in the program because it sustains their interest, they are not bored by it, compared to the teachers' chalk and talk."* Teachers reported also that students enjoyed working on computers and that this was essential in discovering new ideas of solving difficult problems in their subject areas.

7.5.4 Developing confidence in the use of computers

Another contribution of computers to student's learning reported by the interviewees was that the computer technology sometimes encourages learners to gain confidence that enables them to learn other subjects on their own. One of the interviewees stated that *"when the students are in the computer room, they try out new areas of learning in the topics covered by the teachers during normal class time. This helps to reinforce what the teachers taught."* The responses from the interviewees to the impact of computers on students' learning indicated clearly the capability of the computer as a useful tool for teaching and learning in schools.