

## CHAPTER 8

### CONCLUSIONS AND RECOMMENDATIONS

#### 8.1 Introduction

In this chapter the researcher presents the main findings and conclusions of the research and recommendations for action, improvement, implementation and further research. The conclusions are based on the review of the literature and findings from structured and semi-structured interviews, as well as the findings of the questionnaire survey presented in the preceding chapters. All the research instruments have been attached in Appendices 8-12.

The study set out to explore and investigate the whole school integration of computers and in particular how teachers use computers in teaching and learning in public secondary schools in Nyanza Province, Kenya. Firstly, by looking at previous research studies on the use of computers in teaching and learning, and computer integrated education, both in developed and developing countries. Secondly, by examining various government policies on the use of computers in secondary schools, and thirdly, by field research studies to investigate:

- The implementation of the Ministry of Education policy on the use of computers in public secondary schools in Nyanza Province; availability of computers, teacher training in the use of computers, problems and attitudes towards computer integrated education discussed in Chapter 5 Section 5.3 and Chapter 6 Sections 6.4 to 6.4.4.
- Secondary school computer policies and school departmental policies on computer integrated education in teaching and learning presented in Chapter 6 Section 6.4.
- Why and how teachers use computers in teaching and learning, and integrating computers into traditional subjects examined in Chapter 6 and Chapter 7 Section 7.4

This study provided evidence that computers are integrated and used in public secondary schools in Nyanza Province in teaching and learning and in administrative work but to a

very limited extent. The study consists of eight chapters as briefly explained in the next sections:

**Chapter one** set out the main research problem, issues and objectives of the study. The methods used to collect data to achieve these objectives included a review of relevant literature on the use of computers in both developed and developing countries. It also included structured and semi-structured interviews and questionnaire survey research in Nyanza Province. Further evidence presented in Chapter one indicates that computers were introduced in public secondary schools in Kenya because computers give students computer literacy skills that are needed in the modern world. It also discussed the significant of the study, clarified the scope and limitation of the study, basic assumptions, and research questions. In addition, the chapter outlined the conceptual framework, sample of the study, data analysis methods, definition of concepts such as cooperative learning and computer-integrated education were described. The chapter ended with a summary of the organization of the thesis.

**Chapter Two** presented a review of relevant literature that examined the use of computers in teaching and learning in secondary education. It indicates clearly the value attached by educators to computer education as an important tool for teaching and learning and as a supplement to classroom teachers' work in developed and developing countries. Previous research studies suggested that if computers are integrated and used appropriately and effectively it could help to improve students' educational standard and provide more new knowledge of various subjects and confidence in computer literacy skills. Evidence from developed and developing countries reported by Kiboss (2000:119) and Zhao and Cziko (2001:23) also indicates that teachers felt computers helped students to develop accurate and correct communication skills, and perform mathematical calculations, scientific experiments and exploration. Chapter two also explored the functions of computers in secondary education, reasons for using computers in classroom teaching, patterns of using computers, and benefits and limitations of the computer as a tool for teaching and learning. This includes integrating computer education into traditional subjects, teaching and learning computer literacy skills such as word

processing, and using spreadsheet for storing, calculating and presenting information. Teachers reported using computers as tools for generating tables and graphs; creating and using databases for storing and retrieving information; and teaching and learning Programming languages such as Basic and Pascal. They also reported using computers to learn mathematics, science, social studies and languages.

Further evidence presented in **Chapter three** explored factors facilitating and affecting the implementation and use of computers in teaching and learning. This included factors such as need for educational reform, knowledge of skills to implement computer integrated education, availability of computers and support materials, motivation, time for implementation, planning and use, and reward or incentive for teachers. The review of literature demonstrated several factors that inhibit effective use of computers that included lack of suitable training and administrative support, lack of computer equipment, and lack of time to plan and use computers. It also included a discussion on the attitudes of teachers, accessibility to computers, lack of technical support, and cost of computer equipment.

**Chapter four** explained the methods used to collect qualitative and quantitative information and data. The empirical research for this study was conducted using interviews, questionnaires and semi-structured interviews in Kenya, concentrating in Nyanza Province. The interview method was used to investigate government policies and curriculum guidelines for the use of computers in secondary schools. The questionnaires were used to elicit information on school and departmental policies on the use of computer technology, and semi-structured interviews were used to collect data from computer education teachers. Chapter four also discussed the objectives of the field research, research questions, basic assumptions and sources of data. This includes content validation of the research questions, data collection procedures, choosing the sample, administration of research instruments, general plan for data analysis, problems with data collection and field research experience. This was followed by a summary of the chapter.

**Chapter five** provided a detailed analysis of interviews with Senior Education Officers from the Ministry of Education and Curriculum Specialists from the Kenya Institute of Education. It explained the research findings on the existing Kenya Government policy on the introduction and use of computers in secondary education even though the policy is not documented. It also presented information on the reasons for the policy, steps taken to implement the policy, implementation procedures, and problems and difficulties encountered with implementation. In addition, the chapter discussed curriculum guidelines for the use of computers, teacher training and evaluation of computer programs.

Similarly, **Chapter six** presented the research findings on the role of Principals and Heads of Department in the implementation and use of computers in their schools. This included evidence on the school and departmental policies guiding the use of computers in teaching and learning, and the role of the Principal and Heads of Department in the effective utilization of computers. The chapter outlined the research findings from Principals and Heads of Department on the use of computers. This consisted of using computers and computer programs to teach traditional subjects, availability of computers and other related resources, their views and opinions on the potential and value of computers to classroom teaching, teacher training in the use of computers and technical and physical problems. As will be explained in this chapter, the research findings generated in Chapter 6 were similar in most cases to those in Chapter 7 and provided a link for whole school integration of computers as suggested by Cornu (1996) and Dockstadder (1999).

**Chapter seven** described the research findings from semi-structured interviews with computer education teachers. The findings revealed how teachers use computers in teaching and learning. It also reported the types of computer application software that students have learnt, integration into traditional subjects, benefits and limitations of computers, impact of computers on students, and barriers to effective integration and use of computers in teaching and learning.

Lastly, **Chapter eight** provides a review of the thesis chapters, discussion of the main research findings, limitations of the study, implications of the findings for effective CIE in schools, recommendations for improvement, suggestions for further research and conclusions.

The field research was conducted both at the National level, by visiting the Ministry of Education and the Kenya Institute of Education to interview Senior Education officers and Curriculum Specialists about the policy and practice of computer education in schools. Also at the local level through questionnaire survey in twenty five schools, and semi-structured interviews in twenty schools on the use of computer programs in teaching and learning. The results of the study are presented in the following sections.

## **8.2. Summary of the results of the field investigations**

The aim of this summary is to highlight important research findings regarding the use of computers in teaching and learning in secondary schools that participated in the investigations. Firstly, it is established that:

- The Government of Kenya has formulated a policy for the use of computers in secondary schools, but there was no written policy document circulated to schools so the policy was not clear and realistic. There were also no guidelines given to schools for the implementation of the Computer education in schools
- That there were no funds allocated for computer education in secondary schools. Instead secondary schools were expected to find money to purchase computers and support materials.
- There was no government policy on teacher training in the use of computers in teaching and learning. However, the main thrust of the government policy was that, secondary schools should use computers to teach computer literacy.

Secondly, it was evident from the data obtained that:

- Kenya Institute of Education had developed a Computer Education Syllabus and circulated it to secondary schools;

- There were no curriculum guidelines such as computer course books, teachers' and students' manuals and other related materials.
- There were no adequate funds allocated for conducting writing workshops and seminars on computer education for secondary school teachers.
- There was also no evaluation report of suitability of computer support materials used in teaching and learning in schools, or any general evaluation report on the use of computers in secondary schools;

In addition, the findings on implementation of the government computer policy in secondary schools indicated:

- That most of the Principals (76%) had formulated their school policy for the use of computers and practiced "Whole school integration of computer education and used computers to teach computer literacy, traditional subjects and in administration;
- Most of the Principals (80%) confirmed that teachers in their schools were using computers in teaching computer literacy contained in the computer syllabus developed at KIE. This included teaching students word processing, spreadsheets, database and programming;
- That only 48% of the Principals reported having been trained in the use of computers and regarded the training they received very important, but 52% had no training in the use of computers.
- All of the Principals reported having very little money for purchasing computers and other related materials so there was a serious lack of computers and support materials. The other findings indicated that there were technical and physical problems faced by most of the schools that affected the use of computers in teaching and learning such as lack of a technician and suitable facilities for the effective use of computers in the classroom.

Fourthly, the findings from the Heads of Department showed that:

- Most of them (77%) had no departmental computer policy, but 23% of them had a computer policy for the integration and use of computers in teaching and learning traditional subjects;

- Another results showed that 53% of HODs were trained in computer literacy but 47% were not trained in computer literacy. None of them trained in the integration of computers into teaching traditional subjects, although 61% of HODs were very positive about the integration and use of computers in teaching traditional subjects;
- Lastly, the majority of HODs had several problems that hindered effective use of computers by teachers in their departments. 53% of them reported lack of funds, 73% indicated lack of computers, and 71% reported lack of training in computer integrated education, while 60% indicated lack of support materials as some of the main barriers to integration of computers into teaching traditional subjects.

Fifthly, with regards to classroom teachers' use of computers in teaching, the results indicated:

- That 20 teachers from 20 secondary schools used computers mainly as a tool for teaching computer literacy. All of them reported teaching their students' word processing, but 85% used spreadsheets, 70% used database, 40% used graphics and 30% used programming.
- All of them indicated that students learn with computers in a group, but 50% said students learn with computers individually when they are given assignments. 40% of the teachers confirmed that their students had basic knowledge of computer literacy, and 40% said that their students had average computer literacy while 20% had advanced knowledge of computer literacy.
- Teachers reported that the use of computers had an impact on students learning, because students recalled what they have learnt, improved their communication skills, and students discuss with others what they have learnt.
- The majority of them (80%) reported that the use of computers increased their students' motivation to learn, and confirmed that their students learnt new ideas about other subjects such as Mathematics, Science, Accounting and English language etc.
- That 40% of the teachers were integrating computers and used the medium effectively as a tool to help students solve complex Mathematical calculations, 20% used spreadsheet as a tool for manipulating accounting ledgers in business education

subject, 10% of them reported using databases to access relevant information for learning different subjects., some of them reported using computers for teaching main part of the lesson.

- Moreover, the majority of teachers reported that the use of computers has helped to improve students learning traditional subjects, and improved their attention to learning and helped to teach students communication skills such as writing, grammar, spelling, composition, sentence structure and comprehension;
- Teachers reported lack of computers, suitable software and other support materials such as teachers and students' manuals. Others included lack of adequate time for the teachers and students to use computers, and lack of and training in the integration of computers in teaching as the major problems inhibiting the integration of computers into teaching and learning traditional subjects in their schools.
- The majority of teachers (60%) reported that they selected the software, and all of them indicated that they have MS Office Packages. In addition, some of them used Lotus 1, 2, 3, and MS DOS, Publisher and Accounting Packages. The above findings are discussed in details in the following section 8.3.

### **8.3 The main research findings and discussion**

#### **8.3.1 The Government policy**

The research study was designed to achieve five objectives that were listed in Chapter one (see page 5). The first objective was to analyze existing computer integrated education policies in Kenya. The Government policy was analyzed and discussed in Chapter five. With regard to this objective, the findings seemed to be successful. The results indicated that the Government of Kenya has formulated a very brief policy for the use of computers in public secondary schools in accordance with the Education Act CAP211 of 1968 that is still in operation with amendments in 1980s and 1990s. The statement was contained in the Ministry of Education policy circular letter number INS/ME/A/2/1A/51 of 31<sup>st</sup> January 1997 stating that the computers can be used in schools. Although there were no written policy documents specifically for computer technology in schools, it was believed that secondary schools would automatically

implement the use of computers to teach computer literacy skills. The Ministry of Education took a short-cut step to introduce computers into secondary schools without having a pilot project on a small scale so all public secondary schools were free to introduce computer education in their schools. This step was probably adopted due to the fact that computer application programs used to teach computer literacy skills were the same as those used in business and had been proved useful. However, the introduction of computer education without prior planning has led to many problems such as lack of implementation procedures, uneven patterns of utilization, difficulties with access to computers and support materials, lack of funds, and poor physical facilities.

The very brief government policy statement did not contain adequate guidelines to schools for effective implementation of computer education. For this reason, it was not realistic and did not take into account the situation in public secondary schools. This had implications for the effective introduction and use of computers in public schools. There were no guidelines about who would provide computers, software packages and other support materials. Teachers were not trained in the use of computers, and there were no adequate physical facilities. This has brought about computer educational inequality in secondary schools and imbalances whereby few schools offer Computer Education subject and few students have access to computer education.

In practical terms, computer education in public schools requires a public policy that clearly expressed the goals, strategies and desired outcomes. But the nature and extent of policy-making for initial and continuing computer education varies from country to country. In some countries the policies for computer education are clearly articulated. In others they are partial or minimal. For example, a study by Mizukoshi, Kim, and Lee (2000) found that there was a policy on the use of computers in Japan. Pearson (2001:279) reported the USA policy for computer education report "Getting America's Students Ready for the 21<sup>st</sup> Century" and the United Kingdom policy report "Connecting the Learning society: National Grid for Learning." Singapore published "Masterplan" for IT, and in Australia the Victorian Government published "Learning Technologies in Australian Schools 1998." Pearson (2001) noted also that Hong Kong published

“Information Technology for Learning in a New Era: Five Year Strategy 1998/99 to 2002/03.” These are just a few examples of policy documents for the use of computers in schools. Such policy documents were not available in Kenya at the time of the interview. However, UNESCO (2002) reports that “some countries are slow to change or revise their policies” while “in others the policies are changed so rapidly and so frequently that those implementing them can be hard pressed to cope.” In this connection, a study by Clark (2000) and Albion (2001) from developed countries found that computers were not used in many schools for teaching and learning.

Nevertheless, despite the Kenya government having no detailed written policy on computer education, the research findings confirmed that the government supports the use of computers in public secondary schools because the subject offers vital skills required by employers. So in order to implement the policy, the Ministry of Education authorized the Kenya Institute of Education to design and produced a curriculum guideline and Secondary Computer Syllabus for all secondary schools for teaching and learning computer literacy as discussed in Chapter 5 Sections 5.3.1. The syllabus could be seen as a de facto government policy document. The syllabus contains the aims and objectives of computer education for secondary schools. It was also established that schools should use computers mainly to teach computer literacy skills and students should sit for an examination designed with input from curriculum developers. The other finding indicated lack of a clear government policy on teacher training and distribution of computers to secondary schools.

### **8.3.2 Government’s financial support for computer-integrated education in schools**

The interviews at the Ministry of Education explored the issue of financial assistance to schools for computer education programmes. The Officer from the Ministry of Education reported that it was not possible to finance computer education projects for secondary schools because of the general decrease in the government budget for schools. This has affected the introduction and use of computers in many public secondary schools. The Officer noted that there was a fall in the budget for investing in computer technology.

This was as result of the implementation of a series of structural adjustment programs by the Kenyan Government that were imposed largely as a result of advice from the International Monetary Fund and the World Bank indicated in Chapter 5 Sections 5.3.5. The structural adjustment programs were intended to overcome the economic and financial crisis facing the country during the 1990s up to now. This meant that the Ministry of Education could not support secondary schools in their attempt to introduce computer education programmes.

As a result, only a few secondary schools that were financially capable implemented the computer policy. This has left most of the secondary schools with no option but to look for funds from other sources such as fund raising or school fees and donations of computer equipment. But the Kenya National Commission for UNESCO (1993:44) saw the danger of donations of computers and reported that “Developing countries are given no chance in the selection of technology for a particular purpose when the technology is in a field connected with foreign aid.” Therefore, lack of awareness of the financial implications resulting from such running costs as maintenance, spare parts, stationary and storage facilities affects the implementation of computer programmes in some schools. This is true with the computers that were donated to Kenyan schools as discussed in Chapter 6. The research findings indicated that some computers had some components missing that could not be found locally, and many of the programs never worked. These issues and financial problems have frustrated most secondary schools in their attempt to implement computer education in their schools. In contrast, in developed countries like USA, funds are increasingly allocated to schools for the use of computers (Dawson 2000). There is need for the Kenya government to devise a strategy to look for alternative funds and to make a clear budgetary commitment to support computer education programmes in all secondary schools.

### **8.3.3 The Roles of Principals and HODs in the integration and use of computers in their schools**

In Chapter 1, Section 1.3 the researcher stated the problem of the study and indicated a lack of information regarding the utilization of computers as tools for classroom instruction in secondary schools in Nyanza Province. The investigation was carried out and various issues concerning the use of computers in secondary schools were reviewed. The findings from previous studies reported by Yee (2000) and Dawson (2000) pointed out the vital roles of the Principals and Heads of Department in the implementation and use of computers in teaching and learning. Issues such as leadership role, policies, provision of computers for use in the school, students' use of computers, amount of use, skills and problems were identified. These issues were investigated in my field research and the empirical research findings were analyzed to obtain information regarding how the Principals and Heads of Department in my study tried to solve them.

The first important issue identified was the school policy and departmental policies on the use of computers. The research findings established that most of the Principals (76%) had some kind of policy for the use of computers and that the computers were used in teaching and learning computer literacy skills, and in administrative work as discussed in Chapter 6 Sections 6.4 and 6.6.4.

However, most Heads of Department (79%) had no departmental policy as shown in Chapter 6 Section 6.4. This could have been due to a number of reasons such as lack of coordination between the Principal's office and the departments, lack of awareness on the part of HODs of their roles as academic leaders to formulate departmental policies, or because some had not introduced computers in teaching and learning. This needs further investigation. It must also be noted that some of the schools investigated were using computers for administrative work only, and some Heads of Department had no access to computers. However, the overall findings established that there were more Principals of Girls' schools with policies than Principals of Boys' schools. as shown in Chapter 6 Section 6.4. This could be interpreted to mean that girls' schools were more positive

about the use of computers in their schools than boys' schools. This finding was contrary to similar previous studies that compared gender responses reported by Comber et al. (1997), Kutnick (1995), and Young (2000) indicating that computer education was a male dominated field.

### **8.3.4 Implementation of the school policy on the use of computers**

According to Jansen (2002:202), the symbolic role of policy is displayed by the ways in which policy pronouncements make reference to issues of implementation. In this connection, the implementation of computer technology into a school system requires proper planning and well-coordinated strategies. Such implementation procedures need to consider educational objectives and related issues like orientation period, training of teachers, supply of computer equipment and preparation for teaching. Failure to address these issues during the implementation period might render the project not being implemented effectively, due to lack of implementation guidelines in Kenya's initial attempt at a computer education policy.

Research studies (Yee 2000 and Dawson 2000) indicate that successful innovations need to be backed up by the Principal's support and vision. Active involvement is a required ingredient for success of computer-integrated education. The research findings from my studies revealed that 80% of the Principals were involved in the implementation of CIE but 20% were not, as described in Chapter 6 Section 6.4. But the results from Heads of Department on the same question showed that 37% of HODs rated the implementation of policy very high, and 30% rated it average but 33% rated it low. The low responses to implementation of computer policy implied lack of adequate preparation for the introduction of computers in teaching and learning, or lack of computer equipment to implement the innovation.

### **8.3.5 Funding of computer-integrated education in secondary schools**

Computing equipment is very expensive. The cost of purchasing enough computers and operating them are some of the main reasons why computers have not been widely used in secondary schools in Nyanza Province. Despite lack of adequate funds for computer education in the schools investigated, the research findings indicated that most of the Principals had set aside some funds for the purchase of computers and support materials. For example, six Principals in the study reported having 46% of their budget of about Kshs 1,000,000 for equipment used to purchase new computers. While five Principals had used 31% of their budget of about Kshs 1,500,000 for new computers. However, the findings from the Heads of Department indicated that 57% did not have any departmental funds for purchasing computing, but 43% had some funds allocated to them for purchasing computers. The overall result showed that very little money was allocated for the purchase of computing equipment as indicated in Chapter 6 Sections 6.5.1 and 6.5.2. What is required now is for schools to work closely with the government and parents to organize fund raising to supplement the government cost-sharing scheme for school equipment

### **8.3.6 Availability of computers in schools that participated in the investigation**

Effective utilization of computers in teaching and learning requires sufficient availability of computers and other related equipment such as diskettes, printers, electricity, and teachers' and students' manuals. In developed countries like America, Britain, Canada and Australia, teachers have guide notes and student manuals are available, and schools have adequate computers (Opie and Katsu 2000:83). This research noted that the study institutions did not have adequate computers and support materials. The participants reported lack of enough computers in the schools. This was an important barrier to the effective utilization of computer education in teaching and learning. Only one school reported having 20 computers that were seen to be adequate for a class of 40 students, but the principal of this school complained of lack of funds to purchase ink, and for repair and maintenance as discussed in Chapter 6 Section 6.6. However, further analysis revealed that the sample of rural schools had more computers than the sample of urban and suburban schools that participated in the investigation. This was due to the fact that

most of secondary schools are situated in rural areas where the majority of people live. Although these findings do not necessarily mean that schools would integrate computers into teaching and learning, they do demonstrate that the nature of usage by teachers is influenced by the availability of computers in schools.

### **8.3.7 Availability of curriculum study guides and texts for the use of computers**

Curriculum study guides and texts such as teachers' and students' manuals, relevant software, a Secondary Computer Syllabus and textbooks provide teachers with information and the guidelines on how to integrate and use computers. Without the necessary support materials the integration and use of computers in teaching and learning cannot be fully effective. Most of the Principals who participated in the investigation reported having a Secondary Computer Syllabus produced by the Kenya Institute of Education. None of the computer teachers had teachers' guide notes from the Kenya Institute of Education because these guide notes were never produced.

However, experience in other countries suggests that teachers could make more effective use of computers and make their lesson presentation effective by using guide notes to help advanced planning and lesson preparation. Teachers noted the importance of support materials and 20 of them expressed their concern about the important role of the teachers' guide notes for the effective use of computers. The majority of the Principals (76%) also reported that teachers' manuals were central to the effective use of computers in teaching and learning as shown in Chapter 6 Section 6.6. The question is who should provide computer support materials to schools. The curriculum specialists at KIE have only produced a Computer Education syllabus for secondary schools. The curriculum specialists at KIE should work out the modalities of how to produce and supply other support materials to secondary schools. This could be achieved easily by involving computer teachers to develop the required support materials and KIE to purchase relevant software for schools to integrate computers into traditional subjects. Moreover, if KIE does not produce computers support materials, schools should try to obtain similar materials from other places. For example, if teachers are teaching word processing they

do not need support materials developed especially for schools in Kenya. They can use support materials that are available in other countries like South Africa or from computer companies.

### **8.3.8 Access to computers in schools for teachers to use in teaching and learning**

It has often been suggested that accessibility to computer equipment influenced the integration and use of computers in teaching and learning (Sandholtz 2001). Access to quality software is also considered to be an important factor that encourages teachers to integrate computers into traditional subject teaching. It is assumed that once the computer equipment is available, teachers would use it for teaching and learning, and this assumption seems to have been made in Kenya. But the nature of equipment and software can also be a factor limiting usage. Furthermore, access to computer equipment does not just mean obtaining a computer or software, but it includes getting it and using it as required. These issues were investigated in my study and the results revealed that 50% of Heads of Department reported their teachers had access to computers but 50% of them reported that their teachers had some problems of access to computers. They complained of lack of enough computers and a crowded timetable that did not allow them to use computers adequately as explained in Chapter 6 Section 6.6.3. Therefore, it can be concluded that lack of access to computer equipment was a barrier to effective computer integrated education in the schools investigated.

### **8.3.9 The use of computers in the schools that participated in the investigation**

Despite the problems reported by Principals and Heads of Department regarding the implementation and use of computers in secondary schools, it is evident from literature (Bitter 1989; Heinich et al. 1996 and 2002) that computers can be used effectively in education. There are many ways in which computers can contribute to improving education and continue to contribute to the process of improved teaching and learning. Firstly, computers can be used as tools to teach students computer literacy skills such as using word processing to compose stories or to improve writing skills. Secondly,

spreadsheets can be used to create work sheets, storing, calculating and presenting information, or to provide mathematical functions such as logarithms and trigonometric or use them as tools for generating tables and graphs. Thirdly, databases can be used for filing, storage and retrieval of information, or access to information already stored. Fourthly, teachers can use computers to teach students the computer programming languages such as Basic and Pascal etc. Fifthly, computers can be integrated into teaching curriculum subjects like mathematics, science, social studies, and languages as explained in Chapter 2 Sections 2.9.5 to 2.9.7, and in Chapter 6 Section 6.7, Chapter 7 Sections 7.2.10 to 7.3.5. Sixthly, computers can be used in administrative work for keeping school records, preparing school budgets and preparing examinations and this also contributes to improved teaching and learning. The research findings from my study indicated that computers were used in these ways in some public secondary schools in Nyanza Province. The participants gave various reasons for using computer programs. They reported that computer programs were used to teach computer literacy skills, and this also helped to improve students' communication skills. This involved using the computer to teach students how to open their files, store and retrieve information, compose stories and save their work. Teachers reported that the use of computers helped to motivate students to learn because students enjoy working with computers. Most of the computer education teachers (80%) noted students are excited when it is time for computer lessons and more interested in computer lessons than in other subjects. Tiene and Ingram (2001:173) expressed similar sentiments when they observed that just getting the opportunity to work on the machine could be motivating to the children. The majority of the Principals confirmed that computers were used in their schools and (80%) reported that teachers use computers for teaching and learning computer literacy and 16% used computer for administrative work. While 37% of Heads of Department confirmed teachers integrate and use computers as a teaching and learning tool as discussed in Chapter 6 Sections 6.7.1 and 6.7.6. However, it must be remembered that the 25 schools from which data were gathered represent less than 5% of the 524 secondary schools in Nyanza Province so, overall, the use of computers in schools in this province was extremely low at the time of this study.

The programs used by the teachers to teach computer literacy skills were those in the Secondary Computer Syllabus produced at the Kenya Institute of Education. However, there were differences in the extent to which computers were used in teaching and learning. Some schools reported using computers at least five times a week, others used computers four times and still others used it two or three times a week as indicated in Chapter 6 Section 6.7.6, Chapter 7 Sections 7.4.1, and 7.4.2. Because of these differences in the amount of computer usage in school, it would be helpful if the Ministry of Education issued clear policy guidelines to schools stating the number of periods per week for computer education. This will enable all students in schools with computers to receive equal time for computer lessons in the same way as time is allocated to other subjects.

### **8.3.10 Integration of computers into the teaching and learning of traditional subjects**

Integrating computers into the school curriculum means introducing new methods and strategies of teaching and learning in the classroom. It provides students with a learning environment that is student centered. Previous researchers supported the integration of computers in the teaching of the traditional subjects (Dockstadder 1999; Mills and Ragan 2000) because CIE offers considerable advantages to students in achieving more balanced learning outcomes. The research findings from my studies revealed that computers have been integrated and used effectively as a tool to help students solve complex mathematics calculations, and to help students to learn specific skills in various subjects. The findings indicated also that teachers used spreadsheets as a tool for manipulating accounting ledgers in a business education and accounting subject. Furthermore, the results showed that with databases, computer integrated education enables students to access relevant vast quantities of stored data on different subject topics as shown in Chapter 7 Sections 7.4.2 to 7.4.3. However, there were many barriers to the full-scale integration of computers into the teaching of traditional school subjects. Teachers reported a lack of training and information guiding the integration, and lack of computers and relevant support materials.

From the above research findings, it can be concluded that computer integrated education has an important part to play as an effective supplement to traditional teaching methods. Computer integrated education has the potential to be effective instructional mode when measured by the results of students' learning achievement. Furthermore, CIE appears to be more effective in individualized learning, group learning, whole class instruction and in problem solving. Another important value is that it involves individual student actively in the learning process. It enables the learner to proceed at his own pace, which has strong implications for the education of both slow learners and the advanced students. In this way, the computer has been viewed as extremely useful for remedial teaching. Since the findings from this study have provided valuable information regarding the move taken by teachers to integrate computers into teaching and learning traditional subjects, it is important that KIE embark on producing well-designed curricula that integrate computer technology into various subjects for effective utilization in secondary education in Kenya.

There is ample evidence in the literature that when computers are integrated into the study of traditional subjects such as science they can improve students' learning. However, the potential for computers to improve learning cannot be realized unless two important things are in place. First, the teachers must be skillful in teaching in traditional ways so that they know how to motivate learners, how to explain things clearly, how to assess learning in appropriate ways, and so on. Second, the teachers must be very knowledgeable about the subjects they are teaching so that they can recognize when it is most appropriate to use computers as a teaching tool. The present study did not investigate either teachers teaching expertise or their knowledge of the subjects they are teaching so it not known how these factors may be limiting the use of computers by the teachers in Nyanza Province.

#### **8.4 How computers are used and reasons for using computers in the classroom**

Various patterns of how computers are used in teaching and learning were identified in this research. Firstly, there was instructional use of the computer as a tool for teaching computer literacy skills that was common in all schools. The computer applications listed

in the computer syllabus produced by KIE played an important part in the teaching and learning of different computer literacy skills. This included:

- Using computers for teaching and learning word processing, spreadsheet, database and programming;
- Using computers as a remedial tool for students who lagged behind other students to do extra work or revise what has been taught;
- Using computers for supplementary instruction for average students in the class; and
- Using computers as enrichment for students who are ahead of the rest of the other students in the class;

In addition, teachers indicated conducting classes in a teacher-centered approach and this involved:

- Using the computer mainly for drill and practice, after which students learnt in groups of two, three, or four sharing one machine, and sometimes students used the machine individually during examinations.

Moreover, teachers reported using computers for whole class instruction particularly when introducing students to a new topic, new skills or concepts as indicated in Chapter 6 Sections 6.7.2 and Chapter 7 Sections 7.4 to 7.5.

Secondly, teachers reported using computers to supplement classroom teaching of traditional subjects. Teachers stated that computers were useful tools for teaching some topics in the curriculum such as accounting, science, mathematics and English language especially communication skills, comprehension, grammar and spelling. Some teachers used computers for enrichment and extending topics beyond what is normally available in the curriculum as explained in Chapter 7 Sections 7.3.1.

Some teachers indicated that they use computers because it facilitates easy and faster acquisition of knowledge. However, this study did not seek empirical evidence to support these claims.

This study has also shown that schools use computer programs to meet a great variety of educational needs, both in school and out of school, and that teachers believed that computer programs could make a significant difference in the quantity and quality of learning. Participants reported that computers provide benefits such as giving students experiences that would be difficult to provide in any other way, and providing the teacher with new information that helps to explain subjects such as English language better. Most of the English language teachers and students regarded computers as an important tool that helps students to learn new and difficult words by providing immediate feedback on any mistake they make. So the computer helps students to improve their English vocabulary, spelling, sentence structures, grammar and comprehension. It also helps teachers to vary their lesson presentation, and use practical work that students enjoy. Participants noted that computers stimulate students' imagination and offer experiences not provided by the teacher that help them to build on traditional subjects they learn.

The use of computers is now an important part of secondary school life in Nyanza Province secondary schools where the data were gathered so there should be whole school integration for all subjects in the school. Teachers believed that the use of computers could produce a significant improvement of the educational results if they are appropriately used. However, good results depend on how the computers are used as a tool to help solve classroom problems. For example, one of the computer education teachers reported that *"because my students are not performing well in mathematics, the computer helps me to teach topics such as statistics, graphs, square roots, cube roots and means etc."* Another teacher reported that *"since I started using computers and since in form three students use MS Word their language has changed and this has helped to widen their vocabulary."* At the same time, a science teacher reported that *"If I am using a computer during literacy classes I may make reference to the topic in my subject then students look at it in the computer."* Moreover, one of them said *"I usually put the notes in the computer so the students come to the computer room and read it. It is like you give them a handout and they learn from it. I believe it helps them to learn on their own."*

Despite the computer being introduced in secondary schools in Nyanza Province only recently, and with all the shortcomings and lack of equipment and software, computers are making positive contributions to teaching and learning computer literacy skills and traditional subjects. There is urgent need for teachers to be supported by the school administration to integrate and use computers effectively.

### **8.5 Training teachers to integrate and use computers in teaching and learning**

Previous researchers (Dugdale, 1994:249; Gobbo and Girardi, 2001:68; Holland, 2001:245) have argued that in order to use computers effectively, successfully and appropriately, all teachers should be trained and need to be competent to use computer applications in teaching and learning. This study suggests that the effectiveness of computers as a tool for classroom instruction could be improved if teachers are trained and are conversant with the stages of the applications of computers in teaching and learning suggested by Jakobsdottir (2001:88-89). These stages include familiarity and confidence, integration and adaptation to other contexts and creative application to new contexts. My research findings showed that the majority of the Principal, and Heads of Department who participated in the investigation had no training in the use of computers, but the majority of teachers (95%) interviewed in the study institutions had some training. However, it must be remembered that the 20 secondary schools that provided data for this study represented just 4% of the total number of schools in Nyanza Province. As far as the researcher could ascertain, none of the other teachers in these schools had any training or experience in the use of computers in teaching and learning.

Training of teachers in the use of computers could be a step forward in motivating them to change their beliefs about the use of computers and help them to utilize computer technology more effectively in teaching and learning. It would enable them to integrate computers into traditional subjects so as to improve lesson presentation. Although Jakobsdottir (2001:88) argues that changes from traditional methods of teaching could be difficult and time consuming, I believe that if all teachers are aware of the benefits and have the skills required to use computers effectively most of them will integrate it into

their teaching activities. In addition, other methods to overcome these obstacles would be to employ computer coordinators at the school level and provincial level to work as change agents, to provide a link between the Ministry of Education and the schools. These coordinators could also train teachers, provide technical support, organize schools' instructional computing programs and advise teachers as needs arise.

Evidence from semi-structured interviews and the questionnaire survey showed that teachers would appreciate training in the use of computers as discussed in Chapter 6 Sections 6.8 to 6.8.2 and Chapter 7 Section 7.8.2. Teachers need to know and apply computing skills relevant to students' abilities and level of education. They also need to be aware of technical problems such as trouble-shooting. Pre-service training of teachers in the use of computers could be promoted if all students in the teacher training colleges and universities were encouraged to use computers during their studies and during teaching practice. All the participants supported the need to attend short in-service courses and workshops. The interviews with teachers revealed that only 45% of them had attended an in-service course on computers. The effective utilization of computers requires up-dating teachers' knowledge on new developments in computer-integrated education.

### **8.6 Technical and physical facilities, and problems with the use of computers in the classroom.**

As with adoption of any curriculum innovation, the use of computers in teaching and learning presents teachers with many problems and challenges. Teachers in the schools investigated experienced several difficulties that made the implementation and use of computers difficult, and sometimes impossible to achieve. Some of these problems included teachers' beliefs or attitudes and others were school-based problems. The findings indicated lack of enough computers for students, lack of teacher training, low level of confidence in the integration and use of computers, and lack of enough funds to purchase computer equipment as major problems inhibiting the effective use of computers in schools. Further results showed that 56% of the Principals had not

employed a technician. However, the presence of a computer technician would be important in encouraging teachers to use computers. All the participants reported that they needed technical support in hardware and software operations, maintenance and expert advice on the integration and use of computers. While some schools had a computer room or center, only 88% of the schools had a supply of electricity that was adequate for teaching and learning with computers. Other schools used power from generators that was not adequate for effective teaching and learning with computers.

### **8.7 Views and attitudes of the participants about the value of computers in education**

The attitude of teachers towards computers as a tool for teaching and learning is an important determinant factor of the effective implementation and use of computer integrated education in schools. Since decisions about whether and how to use computers in teaching and learning are heavily influenced by the teachers' views and attitudes, and by their perceptions of the value and benefits of computer integrated education in motivating students to learn it was necessary to investigate their attitudes. While factors such as accessibility of equipment clearly influence teachers' attitudes, their willingness to incorporate computer programs in their lesson plans is also vital. This study has demonstrated that most teachers in the case study, the Principals and Heads of Department had a positive attitude towards the use of computers in teaching and learning. Some of the Principals (about 61%) rated the use of computers as excellent and good for the students, but 30% rated it as fair while 8% rated it as poor. At the same time, 89% of the Principals had a positive attitude about the impact of computers on students' learning, and 87% of HODs rated computers as valuable tools for classroom instruction. However, a few of the participants showed negative attitudes towards the use of computers in teaching and learning. This could have been due to a lack of suitable school environment for computer-integrated education, or due to teachers' traditional pedagogical beliefs and resistance to change. Therefore, in order to encourage teachers to introduce computer integrated education in teaching and learning administrators need to create a better school environment by providing more training opportunities, more workshops, technical

support and rewards to computer teachers. Then other teachers may eventually be motivated to integrate and use computers in teaching their subjects.

The other research findings indicated that teachers believe that computers contribute to students' learning in various ways. Some teachers believe computers keep learners abreast with modern technology and make them keen and sharper in solving educational problems. Others agreed that using computer applications enables students to gain new ideas on various subjects, perhaps more than would be provided by the teachers. Some of the findings revealed that participants believed the use of computers introduced new ideas to teaching and learning, increased students' curiosity, promoted creativity, provided current information, and encouraged sharing of ideas through Internet and e-mail services. But others expressed opposing views and argued that although the computer is good for generating new ideas, it should not be used to replace the teacher and thereby cause unemployment for many teachers if it is integrated into subject teaching. This view could be attributed to fear of computer technology that some teachers have or due to lack knowledge of how to use computers or due to resistance to change. However, some of the findings suggested that computers do not help students with speaking skills whereas this is an advantage of radio and television/video programs. Others revealed that computers do not allow students/teacher relationships, interactions or face-to-face discussion that can be achieved by a classroom teacher.

The findings of this study have much practical significance for researchers, policy makers and teachers involved in the integration of computers in schools in Kenya. The overall qualitative and quantitative data from my study provide a useful basis from which to reflect upon the need to introduce computers in schools by the government. The study highlighted some of the current realities and future vision for computer-integrated education in Kenyan schools.

## 8.8 Suggestions and recommendations regarding the use of computers in the classroom

On the basis of the results of this study, the following recommendations are made:

### 8.8.1 Government Policy

The findings of this study indicated that Government policy for the use of computers in public secondary schools in Kenya is not fully effective due to lack of written policy document and guidelines circulated to schools. Even though there was no official policy document on the use of computers in Kenya, the government officials interviewed reported that the Kenya Government supports the idea that computer is important. *This study recommends that the Kenya Government should publish a policy document for the use of computers in schools, and guidelines on the policy implementation to be issued to all schools and field education officers.* When drafting this policy, the government will need to take into account at least the following issues:

- The need to provide a clear objective rationale for requiring Kenyan school students to develop knowledge and skills in computing.
- The question of whether computer skills should be developed in public primary schools;
- The needs for appropriate teacher training. This training should be geared towards pre-service student teachers and re-training serving teachers;
- The value of compulsory computer integration in science and mathematics subjects;
- A clear plan for financing computer education in schools, curriculum development and an evaluation programme.
- Plans for putting up computer laboratories and getting schools connected globally through the Internet.

However, some important implications from this recommendation need particular attention:

- The government must set aside money for purchasing computers or develop realistic strategies for obtaining funds from outside sources;
- The Ministry of Education must work closely with KIE and schools for the implementation of the computer integrated education policy;
- The Ministry of Education must work closely with Faculties of Education at the universities and teacher training colleges to train teachers in CIE

Therefore, the government needs to introduce a policy to make computer education compulsory for all students in secondary schools, and a clear guideline should be provided to Principals for the implementation of this policy. It should contain all the procedures necessary for effective implementation so that all teachers can be aware of what is expected in teaching and learning with computers. Lack of clear and appropriate policy guidelines for teachers affects the implementation of computers in schools. There is need for a policy document for the implementation of computers in schools. This should be similar to the policy implementation guidelines from the USA, UK, Hong Kong, Singapore and Australia (Pearson 2001) that were reported in Chapter 2 Section 2. But the implication is that the government will have to address the following issues immediately if computers are to be used in schools effectively:

- Encourage the training of computer teachers;
- Provide financial assistance to schools for purchasing computers and software;
- The Ministry of Education and Kenya Institute of Education to develop a policy guideline for schools, and provide teachers guide notes, students' manuals and textbooks for effective implementation of CIE.
- The government should encourage the school community to be computer literate. The implication here is that the government will have to establish community resource centers where people could learn basic computer literacy. To seek for donors to assist in developing such centers, and to employ computer teachers. It will also require people to pay some fees for using computers.

### 8.8.2 Role of Kenya Institute of Education in developing CIE related materials

Kenya Institute of Education was established to conduct research, design and produce curriculum materials for schools and teacher education below university level. This study therefore, recommends that:

- *The Ministry of Education in conjunction with Kenya Institute of Education should design secondary curricula that include the integration and use of computers in different subjects;*
- *Kiswahili language should be promoted by using computers as in other languages such as English and French;*
- *Curriculum specialists need to visit teachers more frequently to identify the problems they are experiencing and receive suggestions for improvements to the curriculum;*
- *KIE needs to identify curriculum areas in all secondary schools subjects into which computers could be integrated and select experienced subject teachers and computer teachers to work with curriculum specialists to design and develop teaching and learning materials for CIE in schools;*
- *Since most public secondary and primary schools may not be able to purchase computers immediately for teaching and learning, KIE should conduct research and develop computer curriculum for all grades that does not necessarily require practical work. This will enable all students to have theory classes in the same way as they do in other subjects to prepare them for practical work in future.*
- *KIE should organize writing workshops for Kiswahili teachers to be trained in software design or assisted to write interactive lessons that the designers of software can use in order to produce interactive Kiswahili lessons;*
- *Schools should be encouraged to look for other relevant computer materials from other countries such as South Africa which they can use in the integration of teaching traditional subjects, as it would be expensive to produce computer materials specifically for Kenyan schools. This would be less costly and a quick way of getting computer resources for many schools.*

- *The Government should establish a National Computer Technology Resource Center at KIE to design and implement various training programmes, to offer advice to schools; to carry out evaluation of computer programmes in schools; to be involved in curriculum development for computer integrated education in the school curriculum; to act as documentation center for CIE; and to carry out basic research and development in new areas of computer technology; and to set up a link arrangement with international organization, institutions, for information exchange and staff development*

The above recommendations have the following implications:

- Financial implications for organizing writing workshops and production of Computer Education materials such as teachers' guides, students manuals, course books and distribution to schools;
- Time to plan for Kiswahili software project research, design and re-training of teachers, production of materials and dissemination of information and computer materials to schools;
- Project team leaders and recruitment of local staff and resources for the project.

### **8.8.3 Provision of computers in public secondary schools**

According to the Ministry of Education Officers interviewed, the government has no funds to finance computer education in secondary schools. This includes provision of computers to schools, and training of teachers in the use of computers. The high cost of computer equipment and support materials is an issue that needs to be addressed by the government. Firstly to promote the use of computer in the country and to help public secondary schools to implement computer education policy effectively. One of the major factors identified by the respondents that affected the use of computers in schools was lack of computers in schools reported in Chapter 6 Section 6.6. Secondly, since the government of Kenya has no policy for financing computer education in secondary schools and in order to overcome the problem of lack of computers in schools, the study makes the following recommendations for action:

- *There is an immediate need for the government to investigate viable ways of making computers available to schools so that schools could purchase enough computers for students and so that teachers could also own computers and use them at home to upgrade their skills.*
- *The government should approach business communities to donate computers to schools;*
- *The government should remove all taxes on computers imported into the country to reduce the cost so that parents and politicians can donate computers to schools;*
- *For effective integration of computers into teaching and learning, schools should have enough computers so that at least five students can use one computer as was suggested in the Secondary Computer Syllabus supplied to schools to allow or enhance accessibility by all students.*

However, the following implications need to be considered by the Ministry of Education. Firstly, the government will have to use its machinery to solicit funds from developed countries to assist schools with funds to purchase computers and related support materials. Secondly, the government will need to re-examine its budget to allocate some funds for secondary schools for computer-integrated education. Thirdly, the government will need to approach Non Governmental Organization to contribute computers to secondary schools. Fourthly, schools will have to put up large computer rooms for students to work comfortably with computers.

#### **8.8.4 Role of Principals in the integration and use of computers in schools**

There is need for each school to have a whole school policy for the integration of computers in the curriculum. By integrating computers into traditional subjects, effective utilization will be realized because many teachers will be involved in computer integration in teaching and learning. Teachers will also use computers to keep students records and analyze examination results. While the Principals will use computers for administrative work such as budgeting, correspondence, staff records, students admission records, examination ranking and other school programmes. It is therefore recommended that:

- *In order to implement CIE in schools, all schools must have a clear written policy for computer-integrated education, and policy guidelines circulated to all departments, parents, PTA members and BOG members.*
- *There is need for Principals to have a clear vision and personal investment in the idea of using computers for teaching and learning. There must be a passion in the Principals' mindset that the use of computers will help to improve the achievement and the education of students.*
- *All Principals must be trained in computer leadership, and management of resources for teaching and learning, and to have some degree of computer literacy in order to appreciate the benefits of computer integrated education in their schools. By being computer literate they will be a role model for the staff and students to emulate for the effective integration of computers into the curriculum.*
- *The Principal must establish a climate for change in the school and school system. The need for change must be clearly understood by teachers, students and the school community. In all CIE activities, collective decision-making should be employed so that everyone in the school community is actively involved.*
- *In order to implement CIE effectively, a school has to involve the community so the Principals parents, PTA, and BOG must work cooperatively to provide computers for use in their schools. This means that important decisions about CIE have to be made by the people most affected and each school has to look at innovation in its own way.*
- *All schools must have adequate funds for computer integrated education. There must be adequate funds for purchasing new computers and maintenance and repairs.*

In summary, there are various implications to the above recommendations that need to be addressed by the school administration. Firstly, since the Ministry of Education have no funds for CIE in schools, the school administration, parents, PTA, and BOG will have to start a school computer project to organize fund-raising for purchasing computers and other related materials. Secondly, Principals of schools will have to look for alternative

solutions to provide computers either by appealing to local personalities such as the politicians, civil servants and business people for donations of computers and other support materials. Thirdly, in order to implement CIE effectively in schools, Principals will need to have proper computer rooms fitted with all the required equipment.

#### **8.8.5 Role of Heads of Department in the implementation of CIE**

As mentioned earlier in Chapter 6 Section 1, Heads of Department are the academic leaders of subjects in their departments. From experience, most attempts at effecting change in classroom instruction fail because leaders have no plan at all or have no idea of how to implement the innovation. This study recommends that:

- *In order to support the school computer policy, Heads of Department must have departmental policy for computer-integrated education and all teachers in the departments must be informed accordingly. This includes having a departmental time table and clearly stated objectives for the integration and use of computers in education;*
- *All Heads of Department must be re-trained in computer integrated education in their teaching subjects;*
- *All heads of Departments must be re-trained in the management of computers in education for effective teaching and learning;*
- *All Heads of Department must have at least a computer in the department.*
- *Heads of Department must identify training needs for teachers in their departments and develop a plan that will facilitate staff development programmes in computer-integrated education.*

Based on the above recommendations, the following implications need to be addressed by the school administration: Firstly, the Principals will have to provide funds and time to ensure that all Heads of Department are re-trained in CIE. Secondly, Heads of Department will have to develop an action plan. The plan should identify how and when the goals and objectives of CIE will be achieved and who is responsible. Thirdly, HODs

will have to establish goals and objectives of CIE in departmental teaching. Fourthly, HODs will need to develop a mission statement for the department. Lastly, HODs will have to initiate professional development in the department. This involves creating a framework that encourage teachers to critically examine themselves as professionals by using evaluation format of the lessons and what one needs to be a competent CIE teacher.

#### **8.8.6 Teachers' use of computers in the classroom**

Teachers are the most important resource in a school. They play an important role in curriculum implementation. Teachers should be sufficiently involved in computer application in class. Just getting some basic computer skills is not enough and will not provide teachers with computer skills to provide solution to problem of effective computer integration in class. Research from developing countries like USA and Britain suggest that teachers must be prepared to integrate computers into teaching and learning (Bitner and Bitner, 2002; Crawford, 2000; Zhao and Cziko, 2001; and Nisan-Nelson, 2001). Therefore, in order to achieve the goals of CIE in schools, this study recommends strongly for immediate action that:

- *Teachers must be trained to learn how to integrate computers into their teaching process.*
- *Effective in-service teacher training course for serving teachers must be addressed by the government and under taken by the Ministry of Education at Provincial, and District level. The government must draw relevant programmes to ensure that all teachers are trained in CIE for classroom instruction.*

This can be achieved by involving Inspectors of schools and teacher trainers such as computer experts from the computer colleges, and personnel from Faculty of Education offering computer courses to pre-service teachers. In addition, the researcher recommends that:

- ◆ *The Kenya Institute of education in conjunction with the Provincial Director of Education in Nyanza Province should organize seminars and writing workshops at district level for teachers to learn and produce computer materials for various subjects, and to exchange views regarding computer-integrated education.*
  
- ◆ *Principals should work closely with computer firms or companies to provide opportunities for teachers to attend workshops or exhibitions aimed at increasing the competency of teachers who are computer literate to receive advice on computer applications software.*

This can be achieved if the Principals getting information from computer firms about displays of new computer and other components, teaching and learning resources, open days, exhibition days and any education programmes useful for teachers to attend. Moreover, it is recommended that:

- *The Principals should adopt a much more flexible school based re-training model recommended in section 8.4 to motivate more teachers to use computers in teaching and learning.*

This can be attained if the school provides administrative support to teachers and to encourage them to have some time to attend computer lessons intended to refine their computer skills. The services of newly trained teachers with computer knowledge could play a vital role in bringing innovative ideas for using computers in teaching and learning. Or the Principals could invite experts from computer training colleges to retrain teachers.

However, the following implications for an effective staff development need to be addressed by the school administration. Firstly, training needs of the staff as a group and the various individuals must be assessed accurately. The Principals will have to use staff appraisal and investigation to identify teachers who really need re-training in computer integrated education. Secondly, training programme will require careful planning, so both

individual and group re-training must focus on recognized needs and must be monitored regularly. Thirdly, high standard of performance must be established and evaluated. The goals will have to be set for all participants. Fourthly, the Principals will need to readjust staff work time programmes to provide time for interested teachers to work in the computer room, and to provide incentive or reward to the newly appointed teachers who provide such services to staff members. Lastly, positive support from the Principal must be provided to teachers.

### **8.8.7 Need for specific pre-service teacher training in CIE**

If teacher-education programmes are to achieve their goals of creating confident and competent classroom computer teachers there is need to consider the necessary components of the required skills and inherent motivation to use the computers effectively and widely in instructional settings. It is therefore recommended that:

- *All pre-service teacher education programmes must include computer literacy courses and CIE in various subjects.*
- *Teacher training institutions and Faculties of Education in universities need to use computers in teaching to demonstrate their competency and serve as role models for their students to integrate and use computers.*
- *Faculties of Education and teacher training colleges need to provide intensive training of all pre-service teachers in the integration and use of computers. Pre-service students must use computers during teaching practice and be assessed before joining the teaching profession. Such training should include special methods of teaching with computers, subject integration, lesson planning and preparing schemes of work, trouble shooting problems, and be able know the basic components of modern computers and peripherals as well as their main functions;*

- *The Teacher education programme at Maseno University as well as in other universities in Kenya should expand pre-service teacher training programmes to include computer-integrated education for regular and part time students.*

This can be achieved by restructuring some of the present courses offered in the department of Educational Communication Technology and Curriculum Studies to another approach that would effectively provide integrated training programmes for a wide range of teachers. Such courses should include:

- Restructuring the academic programmes for the Bachelor of Education degree and the Post Graduate Diploma in Education to in-corporate computer integrated education;
- Design a new short certificate course programme to improve skills of teachers in methods of teaching and CIE;
- Design a new degree programs such as BEd (Hons) in computer integrated education for serving teachers in specific subjects like Mathematics and Science;
- Design a new Advanced Certificate in Education (ACE) in computer-integrated education.

These new courses suggested are very important and the academic administration needs to consider them for implementation. In summary, there are at least five implications for the above that need to be addressed. Firstly, lecturers will have to be trained in computer-integrated education to be able to train teachers. Secondly, the University will have to recruit new staff and provide resources for teaching and learning. Thirdly, the lecturers will have to design course content for the new degree and certificate programmes. Fourthly, the University will have to provide funds for administration of the courses and staff remuneration.

The other implication for the introduction of new courses is that of time. The training needs of teachers as a group and the various individuals must be assessed accurately.

There is need to consider the amount of time that it will take various individuals to master a concept or skill. Because people learn differently, some people take longer to learn a given piece of knowledge than it does to others. This will require careful planning and a variety of approaches. To alleviate the problem of time, training institutions will have to develop modules for short time and further training for computer teachers that can be conducted during the university vocation, and also to provide evening classes at specific urban centers for teachers interested in the training.

### **8.9 Re-training model for serving teachers in computer integrated education**

Teachers are central to effective teaching and learning in schools. They also represent the Their role in curriculum innovation requires knowledge in methods of teaching and use of resources to help improve classroom instruction. Thus, their preparedness and professional development is necessary for the success of any curriculum innovation. From experience, there are three major approaches to professional development of teachers in teacher education that focuses on serving teachers. These training can take the following forms short and long courses such as continuous on-the job training, short in-service training and the formal part time graduate degree programme that takes long time to be completed. This study recommends that:

- *In order to help more teachers know how to use computers and modern teaching methods, the Principals should organize some short-term training courses for the teachers during school holidays..*

In such a training programme, facilitators should be drawn from computer firms, computer colleges and universities or colleges of education training students in the use of computers. The components of the training contents should be in two parts. One part to concentrate on the basic computer knowledge including operating system (Window 98, Window 2000, Office series (Word, Excel etc) and the use of Internet. The second part should deal with helping teachers to integrate computers into traditional subjects, while those teachers with advanced training in computers should learn to make teaching software. To motivate teachers to attend the in-service training during the holidays,

academic credit should be awarded to those who complete the course, and a certificate offered by a recognized body such as the Kenya Education Staff Institute (KESI).

- *All serving teachers should be provided with on-the-job training in teaching with computers. The training should be offered during teachers' spare time while normal teaching work can be kept as well.*

The purpose of such training should be geared towards helping teachers to acquire the knowledge, skills, attitudes and ability if teachers are to use computers effectively in the classroom. Schools should have their own computer resource persons (experts) to run the course. The school should encourage teachers interested in computer in education to take computer home for the week-end or during school holidays. These and other approaches to staff development in the use of computer in education need to be expanded if computers are to achieve their potential in schools.

Therefore, in order to realize effective implementation of computer integrated education in each school, there is a need for Principals of secondary schools in Nyanza Province to devise a method of staff development similar to the one suggested by Cooley (2001:269-282). The 'Teachers as Trainers Model' is a school based training method that comprises of four interrelated stages that include:

- Needs Assessment;
- Selection of Staff and Planning;
- Process of Training;
- Personnel and Program Evaluation.

These stages of training of teachers in computer technology use are more than the usual staff development organized by the Inspectors from the Ministry of Education. The requirements for TTM include creating a common vision or goal, department and staff empowerment, cooperative planning to establish and maintain trust and credibility, spirited, freedom of communication, continuous assistance, shared responsibility, meaningful program, personnel assessment, and reward or recognition of achievement

(Cooley 2001: 171). The 'Teacher as Trainer Model' is appropriate for implementation in Kenya because it would help to promote effective utilization of computer technology in secondary schools.

The 'Teacher as Trainer Model' is dependent upon creating and maintaining a transformational work environment. It is less costly than out of school in-service course organized by the Ministry of Education at regional centers and sending individual teacher to attend training in local commercial computer colleges. So the model would be suitable for training may teachers in the use of computers. When systematically implemented, the steps involved in TTM would provide an effective base for computer integrated education innovation. For example:

### **Phase One: Needs Assessment**

A needs assessment is the first step in the 'Teachers as Trainers Model.' This requires identification of the subject topic areas that needs to be covered by the use of computer applications as tools for instruction. The purpose of using the tools should be explained clearly if for example they are to be used for mastery learning, motivation, introducing new ideas, teaching computer literacy skills etc. The 'Teachers as Trainers Model' should represent meaningful, honest discussion between Principal and Teachers. The goal of assessment needs to establish a common understanding of the teachers' teaching needs, after which arrangements for training activities are scheduled.

From the need assessment, each teacher's profile could be developed to serve as a road map for future training. Such training could be based on individual need, interest and skill level in subjects and computer technology. The needs assessment staff profile, will also save time and money by focusing on specific subject requirements, at departmental level.

## **Stage two: Core Team Selection and Planning**

The Selection and planning team could consist of Heads of Departments representing subject areas, and senior teachers. Computer technology teachers could take the lead as trainer in training their colleagues on subject integration requirements. The team members should be competent and knowledgeable subject teachers capable of bringing change. They should also have a positive attitude and be able to implement computer-integrated education in the school. Planning for training of teachers could also include sending them to conferences or workshops and exhibitions that would provide them time to plan how to implement CIE in the classroom.

Since Heads of Departments are expected to play a leading role in course development, they need to develop units that respond to students' interest and learning needs, rather than strictly adhere closely to national school curriculum. The team leaders must also work closely with the Principal in all matters of curriculum and staff training. Planning for training sessions, the topics, and other requirements need to be discussed with the Principal for support and encouragement. Principals must be involved because they have a very important role to play in the effective implementation of computer education in the school. Lastly the team members need to discuss with teachers the proposed topics for training and then design appropriate learning needs.

## **Stage Three: Training session**

Stage three of Teachers as Trainers Model is known as “Delivery of Training” and consists of six inter-related components that include:

- **Conceptual framework:** The selected trainers need to explain to teachers the relevancy of the training program in relation to their identified teaching needs. The training session should include opportunity for interaction between teachers and trainers, discussions on the outcome and benefits to learners, and explaining how CIE helps to improve classroom instruction.

- **Guided practice and modeling:** This involves active learning sessions in which trainee teachers deliver their work under the guidance of a trainer. The trainers' role is to provide guided support and encouragement. For example, a trainee might create a program on teaching a topic in accounts or mathematics. The trainers demonstrate how to create the program. The teachers then produce their own program incorporating concepts that will be useful for teaching for improving the subject delivery. The trainers will assess the work of trainees and advise them accordingly.
- **Evaluation pattern:** The next stage in Teachers as Trainers Model is evaluation. It is very important for trainers, teachers and Principals to develop a uniform standard pattern of evaluation of the training aimed at the program goals and intentions. Evaluation plays a powerful role in staff development and is a very useful tool as a basis for assessing each trainee's performance and the success of the training program. It should become a guide for teachers as they put into practice what they learnt during the training session.
- **Psychological and technical support:** Teachers need psychological and technical support after attending a training program. This is necessary because the new ideas and teaching techniques acquired during the course must be put into practice. Trainees need to establish a date and time to meet and discuss experiences with teachers after training, and to address any problems and difficulties with effective implementation. There is also a need for discussion with the principal for the provision of administrative and technical support. A follow-up activity such as attendance at workshops, conferences, or tours to visit other institutions with adequate computer education programs could be quite encouraging and motivating to teachers.
- **Retraining of teachers:** It is important that Education Officers and Inspectors of schools organize and provide adequate re-training courses for teachers in computer integrated education. A short re-training program could provide teachers opportunities to exchange ideas and experiences with other teachers from different schools on the use of computers. To promote change in curriculum innovation, Principals need to allow teachers to attend, provide support, reinforcement for re-training programs that teachers need for effective implementation of CIE.

- **Reward and Incentive:** Incentive and reward after training is the final component in the delivery of training phase. There is need for the administration to acknowledge and appreciate the achievement of teachers after training. Incentives and rewards have a motivational effect that helps to encourage teachers to work hard. This could involve presenting gifts such as certificates of recognition or some kind of present (money or an item) or organized tour. This helps to build positive staff attitude and unity to improve better academic achievement in the school.

#### **Stage Four: Teachers profile and Training evaluation**

The last component of Teachers as Trainers Model deals with evaluation of the whole training program. Even if the Teachers as Trainers Model course is successfully carried out, there is a need to evaluate the whole program of activities. This involves examining the time spent on each course teachers need to incorporate their subjects into computer technology as a tool for instruction, the number of computers and support materials to be used, and financial implications. Accountability and evaluation need to be part and parcel of any teacher-training program. Therefore, the Principal needs to design an evaluation form to be completed by all teachers participating in Teachers as Trainers Model in order to involve teachers in decision-making. In this way, the Teachers as Trainers Model could serve as a powerful motivational tool for teachers and the school for effective implementation of CIE in teaching and learning.

#### **8.10 Limitations of the study**

This study claims that a comprehensive investigation on computer-integrated education was conducted, and it did make some successful and fruitful contributions on how computers are used in secondary schools in Nyanza Province. However, there were various limitations that came up during the course of the field research.

Firstly, this study was limited to Senior Education Officers and Curriculum Specialists dealing with computers at National level. The respondents provided some

of the information that was required for this study but did not respond to other questions. For example, the Senior Education Officer did not have a list of schools with computers, and the Curriculum Specialist reported having produced only Computer Education syllabi for secondary schools.

Secondly, the research was limited to public secondary schools that had computers in Nyanza Province focusing on Principals, Heads of Department and computer teachers. It excluded the participation of students, Parent Teachers Association, Board of Governors, and National Union of Teachers whose contributions are also important in the successful implementation of any curriculum innovation. This limitation was important because the researcher was able to collect the data within the shortest time. It also provided information required for “whole school” computer integrated education as suggested by Cornu (1996).

Thirdly, there were some limitations in the data gathered from schools. Data were collected from all the respondents who were available and participated in the study. Since many schools in Nyanza Province were not using computers, the number of teachers who provided data was small. This problem was made worse when some of the questionnaires were not returned. The researcher was frustrated by the non-returned questionnaires because the information that would have been obtained from them would have provided varied data to add to the other findings. It also caused a lot of psychological frustration of why the questionnaires were not returned despite my visit to the schools concerned several times.

Besides the small number of respondents, various components of this research limited it being generalized. The research was carried out within a few years of computers being introduced to Kenyan schools. Since the use of computers in administration and teaching is expected to improve over a period of years of experience, the situations reported here may change considerably in the near future. Moreover, the data analysis revealed some limitations within school administration that contradicted quantitative

information. So explaining whether teachers' beliefs and attitudes and practices would change with experience needs further study.

Fourthly, while computer teachers reported their use of computers in teaching and learning computer literacy skills and some of them reported integrating it into teaching traditional subjects, it was not possible to investigate the actual usage of computers. It is possible that some of the teachers may have over-estimated their use of computers. The researcher did not observe teachers using computers in the classroom. It is necessary to understand more about the practices, views, attitudes, and beliefs of computer teachers' experiences with teaching and learning with computers in the classroom. By observing teachers and students, and understanding the pattern of use, researchers might be in a better position to identify other strategies that could help to encourage effective use of computers. This could also help to encourage other teachers to use computers as tools for classroom instruction.

Fifthly, it should be noted that the quantitative findings have a limited duration with regards to relevance. The numerical data collected will be out-dated very soon, because as many secondary schools purchase computers and more teachers are trained in advanced computer skills and subject integration, more schools will implement computer integrated education. Therefore, it will be possible to obtain different results if similar studies are conducted in which teachers are involved in teaching and learning with computers. Teaching methods of the teacher changes with experience. The teachers who participated in the investigation had no prior exposure to computer-integrated education so there was limitation on results on methods of lesson presentation.

Sixthly, the use of questionnaires as a research tool has limitations. For example, in this research, the findings indicated that 28% of the Principals had no exposure with computers, and the researcher was not able to ask them why they did not attend the in-service course like the other Principals who participated in the investigation. So getting all the required information is not always possible from questionnaires.

Lastly, all the participants in the study were involved in secondary education. It is important also to examine the use of computers in other institutions such as primary schools and teacher training institutions to determine how they differ from the secondary schools. For example, how do the factors affecting the use of computers in primary schools or higher education institutions compare with the results reported in this study. This could have provided rich data on various computer applications used by different groups for an evaluation of the effectiveness of CIE in these institutions.

Nevertheless, the above limitations do not imply that this study is not valid. Discussing the limitations of research findings is a healthy exercise in educational research for identifying directions for the implementation of the findings and suggestions. Exposing the limitations also helps to generate and stimulate further investigation into similar problems. The data obtained were very useful and the objectives of the study were achieved since the findings indicated that teachers used computers to teach computer literacy skills and some had started using computer-integrated education.

### **8.11 Suggestions for further research**

On the basis of the findings and limitations identified in this study, the following issues need further investigation.

- Since a clear policy document for the use of computers was lacking, there is need to determine how best to formulate and promulgate this policy.
- There is a need for teacher training policy guidelines to look into whether initial teacher education (pre-service) is sufficient to equip teachers for using computer integrated education or whether a major continuing teacher professional development programme in computing skills at school level or in-service courses would be effective.
- Research is needed to determine whether there is a need for change in the secondary curriculum to accommodate computer technology.

- Research is needed in different school subjects to determine how computer education could be integrated into teaching and learning in the classroom.
- There is a need for research to evaluate the impact of computer education as a subject in secondary school.
- Research is needed to determine whether computers should be integrated into some subjects such as mathematics, sciences, languages and commercial subjects and technical subjects only.
- One of the barriers to the implementation and use of computers identified in the study was lack of computer equipment. Although the research established also that some Principals had hired computers for a fee, further research is needed to establish the cost-benefits of such transactions as opposed to schools purchasing their own computers.
- While this study focused on the responses from Principals, Heads of Department and teachers, further qualitative research is required to examine the perceptions and experiences of students learning with computers in the same schools.
- The study also concentrated on Principals, Heads of Departments and teachers in secondary schools excluding, primary schools, parent teachers association (PTA) and board of governors (BOG). Further research could involve these other groups and use a larger sample to determine if the findings of this study could be generalized.
- Evidence from literature (Rice, Wilson and Bagley 2001:226) revealed that students learning with computers “felt they were better prepared for the demands that would be placed on them by the technological society of the 21<sup>st</sup> century because of the computer skills learned in their geography and world events classes.” Further research is required to evaluate the effect of computers literacy courses on students graduating from secondary schools in Nyanza Province.
- Since this study was a first step in examining the use of computers in public secondary schools in Nyanza Province, there is need to conduct a follow-up studies periodically to evaluate CIE in secondary education.
- There is also a need to conduct a study to assess computer-training needs of teachers in primary and secondary schools.

- In view of the fact that the use of computers in schools has become both a pedagogical and political issue in developing countries, so the issue of the computer competence of school leaders is very important and merits an immediate assessment.
- There is need for further investigation to find out why other schools in Nyanza Province were not using computers in teaching and learning.

## 8.12 CONCLUSION

The results of this study provided a range of information regarding the use of computers in public secondary schools in Nyanza Province of Kenya. Some of these findings concur with previous research findings in the literature. The findings of this study revealed that the government has an important role to play in any new curriculum innovation. In so doing, the Kenya Government developed a very brief policy for the use of computers in public secondary schools, but unfortunately did not distribute it widely, and provided only very limited funds to allow the policy to be put into practice. Consequently this study established that the current government policy towards the promotion of computer-integrated education is not fully effective. I was concerned about the lack of definite government policy guidelines, lack of curriculum guidelines, provision of equipment, and policy regarding teacher preparation on the implementation of computer education in public secondary schools that could encourage teachers to use computers. In the past, many educational technology initiatives have resulted in disappointing outcomes due to lack of clear policy commitment (e.g. the school radio and television programmes). Nevertheless, the majority of the Principals of secondary schools that participated in the study had formulated policies for the use of computers. Some Heads of Department also had departmental policy for use of computers in teaching some of the subjects. The findings from this research have implications for both computer-integration policy and practices.

Furthermore, participants reported various factors that affected the use of computers effectively in teaching and learning. The first one concerned the lack of availability of

enough computers and software, and support materials. Initially, the introduction of computers into secondary schools was established with high hopes that computers would equip students with computer literacy skills similar to those of their peers in other countries. These hopes have been only partially fulfilled because only a few schools in Nyanza Province have computers. Although in 1996, with the assistance from UNESCO donations, the Ministry of Education supplied computers to a few selected national secondary schools and developed the computer syllabus. Some schools also went ahead and purchased their own computers as well but the findings indicated that this was not adequate. At present, however, the effective use of computers in public secondary schools is threatened by financial problems, particularly the high costs of purchasing new computers, and repair and maintenance of existing computers to cope with the large number of students in schools. With the rapid expansion of enrolment in schools combined with the financial constraints that resulted in declining government resources there is a serious problem of how to finance the purchase of computers and the repair of existing equipment. Cuts in government spending mean that the question of cost-sharing needs to be urgently addressed and alternative funding for computer integrated education must be devised. Availability of computer equipment would encourage teachers and students to use computers in teaching and learning in order to realize whole-school integration of computers in education.

The study showed also that computers are not integrated and extensively used in the sample of secondary schools that participated in the investigation. However, all of the teachers interviewed were positive about the benefits and usefulness of computers as a medium of instruction. Effective integration strategies need to be devised and have emphasis on computers being used as a tool to improve students' learning of both traditional subjects and computer literacy skills. Some teachers noted that computers could also be used as a way of preparing students for the demands that would be placed on them by the technological world, because computers gives students skills that they need to have to compete for jobs in the world market. A study by Button, Cox, Stough and Taylor (2002:91) found that "companies tend to believe that there are simply not enough people in the IT core occupational fields to meet their growing demands." They

also reported that “economists argue that the IT work force challenge is the expected results of the rising importance of IT in the economy and the consequent demand for highly skilled core IT workers.” The research findings from these scholars concur with those of the teachers in my study although it may not be possible for all students with computer literacy skills to get jobs. But given the situation in Kenya where there are few computer literate people, chances are that graduates of secondary schools have a better chance to get jobs if they are computer literate.

Moreover, teachers reported many examples about the benefits of computer integrated education such as, that computer programs had helped to improve students’ learning, particularly in language proficiency, communication skills, science subjects, mathematics, accounts and in technical subjects. Computer programs are also widely believed to motivate students to learn. The participants reported that students are keen, excited and more attentive to learn from computers. Although there were positive responses about the integration and use of computers, it should be noted that in any usage it is important for teachers to remember that computers serve limited roles and should be integrated with other tools and media in teaching and learning. The use of computers alone will not provide for all the learning needs of all students. Students can also learn using different resources, including textbooks, libraries, experience, museums, videos, television, radio and audio tape recordings, human and locally available resources that are easily affordable.

Furthermore, the study demonstrated that many teachers had not been trained in the use of computers so they lacked the prerequisite skills to utilize computer application tools in teaching effectively. Although some of them reported having participated in some in-service computer training, they indicated that it was too short and not very useful. Although these teachers had limited training, they were motivated to integrate and use computers in teaching traditional subjects such as mathematics, languages, science and accounts. However, according to Nisan-Nelson (2001:84) research has suggests that there “is a tendency for teachers to stay with instructional strategies with which they are familiar and comfortable” and may not be willing to change their teaching methods. So

preparing teachers to use computers in the classroom goes beyond basic computer literacy. Gibson (2001) stresses that teachers must employ a wide range of computer tools and software as part of their instructional repertoire. Therefore, pre-service training of teachers needs to pay particular attention of how to equip trainees with knowledge of how to integrate computers into the curriculum. Similarly, serving teachers need to be re-trained in the integration and use of computers. This training should begin just a few months after teachers have joined the teaching profession. The training should serve as an evaluation of the practical exposure of teachers to new developments in the field of computer technology programs and to serve as an assessment of the teachers' future prospects in classroom instruction.

The data from both questionnaires and semi-structured interviews confirmed that the computer is a useful tool for teaching and learning. However, it was noted that a number of factors to be considered for the professional support for teachers attempting to integrate computers such as technical support, incentives, motivation and administrative support were very important in the effective use of computers.

Moreover, the study indicated that the use of computers requires teachers to adopt new roles to help students pursue their own inquires when using computers. So teachers' instructional practices change from that of a traditional approach of teacher-centered to that of student-centered, in which the teacher acts as a guide, moves around the class helping students and plays the role of a facilitator of learning, while the learners are actively involved in their own learning; sometimes individually, or in a group or in collaborative learning.

The research findings suggest that there is a need to conduct extensive writing workshops with teachers to design and develop various materials from traditional subjects for computer-integrated education. This could be done at provincial level attended by computer teachers. The participants would then be assigned the role of computer specialists who could provide a link between the curriculum center and the school. Although curriculum specialists based at KIE are extremely active in developing new

curriculum materials, there is not sufficient attention given to the design and production of computer support materials. The study demonstrated that only a computer syllabus had been produced and supplied to secondary schools.

The study, therefore underlines the need for immediate action to improve training of teachers in the production of computer materials, provision of support materials, particularly teachers' and students' manuals, and creation of closer links between the Ministry of Education and school administration. The school inspectors need to identify competent computer teachers to coordinate computer-integrated education to help all teachers.

The research demonstrated that teachers in the case study institutions value the use of computers and would welcome more training in advanced computing skills to include the use of the Internet, and support from the Principals to enable them to utilize computers more effectively. The scope and mode of using computers in schools depends heavily on the Principals. The part played by the Principal in the whole school integration of computers helps to determine the effectiveness and efficiency and shapes the manner in which the computer could be utilized by teachers and students. Therefore, if CIE is to be effectively implemented in schools the teachers need support and they must be well prepared.

The study also underlines the need for more research on the cost-effectiveness of alternative CIE strategies such as online learning and the Internet. Finally, the study confirms previous studies in developed countries (Cooley, 2001:269-283; Maushack, Kelly, and Blodgett, 2001:419; Pritchard, 2001:294; Rice, Wilson, and Bagley, 2001:211-228; and also studies conducted in Kenya by Kiboss (2000:199)). These studies reported that the use of computers in schools has considerable potential as a means of motivating students to learn. They also demonstrated that Computer Education helps to prepare students for further studies in computer technology, improving the quality of learning and teaching, widening access to new ideas, increasing students' motivation and raising the standard of education. However, this potential cannot be fully realized unless teachers are

motivated, and trained, and unless steps are taken to address problems identified such as inadequate computer resources, lack of planning time, and lack of support from the administration indicated in the study. These problems require, in turn, the financial implications of computer-integrated education to be fully examined. Only when these problems are overcome will computer-integrated education in Kenya be fully utilized in all schools in the country.

Above all, the study suggests that simply using computers will not bring about all the desired changes in secondary education. The presence of computers alone will not change schools. But computers integrated into an effective learning environment and used with trained and competent teachers with a purpose will help in the improvement of classroom instruction for the benefits of students. The challenge for administrators and teachers is not only to use the computer for the sake of it, but to use it appropriately so that students learn effectively with the computer to realize important educational objectives.