CHAPTER 3

FACTORS FACILITATING AND AFFECTING THE USE
OF COMPUTERS IN SCHOOLS

3.1 Introduction

In this chapter the researcher discusses the factors facilitating and affecting the implementation of computer education in schools. It is concerned mainly with identifying and describing the key factors through a review of literature. As in Chapter 2, the factors are derived from research work in developed and developing countries, and other factors have been cited where necessary from my own experience. The factors are reviewed according to a two-fold classification of categories of factors: factors at school level, and factors at teacher level (Veen, 1996:69). In addition, factors identified by (Anandra, 1998; Carol, 1997; and Chiero; 1997), and other scholars are examined. For ease of the review of related literature, the chapter is organised as follows: First the chapter examines the factors related to the need to improve the quality of teaching and learning (or dissatisfaction with existing curriculum) and, the preparation of students for the future. The second factor concerns the knowledge and skills in computing that exists among teachers to implement computer technology in the schools. This is followed by a review of the availability of resources for implementing innovation. The next factor considered concerns time set aside for effective use of technology in teaching and learning. The chapter then examines the need to provide incentives or reward to encourage teachers to take part in the implementation process. Effective implementation of computers in schools requires support from school administration, commitment by all the parents, and the support from the Ministry of education. The other factors that affects the use of computer includes lack of teacher training and preparation in the use of technology; negative attitudes of teachers towards the technology, lack of equipment and other resources; access to resources; lack of time; technical support; motivation; cost and cost-effectiveness; and the organisational factor. Finally, the chapter ends by summarising the different effects of these factors on the effective integration and use of computers in teaching and learning.

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3.2 Factors that encourage the introduction and use of computers in schools

3.2.1. The need for educational reform

When the government in a developed country realises that there is something missing in the provision of the education offered to children in schools, or there is some dissatisfaction with the present education system, a common response is for the Ministry of Education to conduct an evaluation of the existing patterns of education. This helps to provide more information about whether educational policies and activities have been successful or not. Then the need for change or reform is advocated by those affected. The demand for curriculum innovation can come from the parents for their children to receive the type of education offered to other children elsewhere, or the government can initiate the innovation. In recent years any analysis of the need for changes concerned identification of some needs related to computer technology. For example, Mizukoshi, Kim, and Lee (2000) report that in Japan, the Ministry of Education suggested several reforms in the formal education sector. Some of the innovations stated that computer education was to be included in the curriculum. The others indicated that teaching methods were to change, teaching materials were to be developed, technical training was to be provided, and a support system was to be developed. It included also the improvement of physical facilities, conducting scientific research and provision of the Internet to over 40, 000 schools. The most important factor was the Ministry of Education's support for the innovation that included also compulsory computer education to all junior high school students and Internet connection to all primary and secondary schools by the year 2001.

Similarly, in South Africa, the government white paper of 1997 section 9.7 discussed technology education. The paper noted the need for technology education in schools and initiated "a pilot project to be implemented in the general education phase." The White paper report indicated support to "assist the Department of Education in developing a technology education programme for schools."

The need for educational reform cited above were important and seems to be similar to the process of curriculum innovation in Kenya. For example, prior to 1984 the general education was organised into four sectors: primary school (seven years); lower secondary (four years); upper secondary (two years); and university education

(at least three years). This pattern of education came about after there was an outcry about the education system that was not meeting the needs of the learners due to problems related to poor methods of teaching, teacher education, resources and the curriculum content. The government appointed a commission of inquiry (the Ominde commission of 1964) to collect views and suggestions from the public and made recommendations for the new curriculum. This included evaluating the existing curriculum and teacher training programmes. The Ominde commission of 1964 recommended the restructuring of the curriculum and the introduction of the use of school radio programmes to improve methods of teaching and learning in schools. When there was another complaint from the public about the quality and scope of education offered to the children, the Government appointed a commission in 1981 chaired by Mackay to seek views from the public and compiled a report. The Mackay Report (1981) recommended restructuring the school system from 7.4.2.3 nomenclature that is: seven years of primary education (grades 1-7), four years of secondary education (Forms 1-4), two years of higher education (Forms 5-6), and a minimum of three years university education, to an 8.4.4 system. The new education system (8.4.4) comprised of eight years of primary education (grades 1-8), four years of secondary education (Forms 1-4) and a minimum of four years of university education. The main objective of the new system of education was aimed at diversifying the curriculum of the entire education. The government accepted the recommendations and directed the Ministry of Education to make preparation for the implementation of the revised curriculum in 1985. So a new system of education was introduced which extended primary course to 8 years, a single four–year secondary course was created, and the minimum period of university education raised to four years (Mackay Report 1981). Therefore, the needs for any educational change start from the parents and the society at large and must be examined by educators and researchers in an attempt to provide possible solutions.

3.2.2 Teachers' knowledge and skills are necessary for curriculum innovation

Teachers who implement any curriculum innovation related to computers must posses sufficient knowledge and skills to teach computer literacy skills. This factor is very essential. Teachers must be competent to deliver the required knowledge. The public may demand computer knowledge to be imparted to their children but if teachers have

no skills, then it becomes difficult to implement computer education. Teachers must be competent with the use of computers in order to teach students how to use and learn with the computer tools. Therefore, knowledge and skills must be present for any technology innovation to take place effectively (Chiero, 1997; and Carol, 1997). Similarly, Opie and Katsu (2000:81) reporting from Britain noted the concern of the Department For Education and Employment (DfEE) "to equip every newly qualified teacher with the knowledge, skills and understanding to make sound decisions about when, when not, and how" to use computers effectively in teaching particular subjects.

In a similar study, Dexter, Anderson and Becker (1998:36) stressed that "for teachers to implement any new instructional strategy, they must acquire new knowledge about computer and then weave this together with the demands of the curriculum, classroom management, and existing instructional skills." In this connection, Sandholtz (2001:368) gives an example of how teachers who acquired knowledge and skills of using computers led to increased levels of classroom implementation of computers as one teacher reported "I was a nonuser of computers. Turning one on took major effort. Now I can use one well enough for classroom use, as well as help students do essays, etc. on them." Another teacher said " I gained a feeling of excitement and being capable. I gained a sense of accomplishment a feeling that helped me try new ways to use technology." Consequently, teachers' knowledge and skills facilitates the subsequent integration of computers into classroom instruction. For teachers to make informed choices, Heinich, Molenda, Russell, and Smaldino (2002:212) state Teachers "need to be familiar with the various computer applications-games, simulations, tutorials, problem-solving programs, word processing, graphics tools and integrated learning system."

Teachers can acquire knowledge of computing skills through in-service courses, self-instructional programs, tutorial assistance and formal training. Teachers should be encouraged to continue their professional development in computing.

3.2.3 The necessity of resources for teaching and learning with computers

The teaching and learning materials required to enabled technology innovation to work should be easily available. This factor is the key requirement of all curriculum

innovation including technology. Without the hardware and software it is impossible to implement changes that require such support and other teaching and leaning materials. According to Mizukoshi, Kim, and Lee (2000), resources are tools, and the support materials that are used to learn computer skills in order to acquire learning objectives must be provided. These materials include computers, software, diskettes, printers, teachers' guides, students' manuals and computer textbooks. Clark (2000: 190) reported a common finding that "teachers wanted more software and equipment in their classrooms." Similarly (Zammit, 1992:59) found that "the second most important factor that encouraged teachers in the seven schools to start using computers was software availability." Therefore, based on the research findings from these scholars, it is apparent that provision of computers in schools would definitely encourage teachers to use them.

3.2.4 The availability of time for the use of computers in teaching and learning

Teachers must have time to implement the new technology. They need enough time to learn, adapt, integrate and reflect on what they do in the class with the students. Teachers need time to try things out, and reflect on their success and failures. They also need time to attend in-service courses, they need time to practice with new materials; and time to try out and evaluate new teaching procedures and to attend to their daily teaching load (Carol, 1997; Chiero, 1997; Dawson, 2000; Zammit, 1992).

A study by Dawson (2000:67) indicated that teachers were least satisfied with time for the use of computers. Availability of time is very important for teachers to plan and work effectively. Carol (1997:138) found that availability of computers was perceived as the most vital factor in building up staff confidence to integrate and use computers in the classroom. Other researchers have also expressed similar sentiment (Ertmer, et al. 1999; Hung and Chen, 1999: and Zammit, 1992). Therefore, time is an important factor in the successful adoption of any curriculum change. For example, a report by Coatzer (2001:72) indicated that the "time framework laid down for implementation of C2005 in South Africa in all grades by the year 2005 was unrealistic, because curriculum reform is a slow process" that requires enough time for teachers to train and digest the new curriculum.

3.2.5 Provision of incentives and encouragement to teachers using computers

in teaching

The implementation of new technology in education requires concentration and devotion to duty. For some teachers, performing such work to their satisfaction is enough incentive, but for others it may mean providing them with more assistance such as advice, better facilities or financial benefits and professional development opportunities. It is possible for failure to occur in any innovation if teachers are not recognised and rewarded for the work they do. There must be adequate facilities and consideration of the role the incentives play on the implementation of new technology (Struddler et al.1999; Hung and Chen, 1999; and Parr, 1999) supported the need for reward and recognition for those who use technology. In this connection, Ertmer, Addison, Lane Ross and Woods (1999:65) report that as result of job satisfaction a teacher in their study reported how exciting and motivating computers were for the students and noted "That's my incentive-they get more excited." Another teacher described her own enjoyment in using computers and becoming more competent and remarked that " I'm so much more comfortable with it." Therefore, incentive varies for the individuals and reward for a well-done job could be an effective incentive to encourage a teacher to use computers, while others might need to be provided with material reward.

3.2.6 Teachers' participation in the initial computer technology innovation

The success of any technology innovation program depends strongly upon the support and attitudes of the teachers who will perform the implementation. There is need for shared decision-making that incorporates teachers' input and other educators in educational technology innovation. However, on many occasions, education innovation decisions on new programs are often made by others and handed down to the classroom teachers for implementation. Even if there are policies spelt out regarding innovation procedures, practices at classroom level are another thing. Unless teachers who are expected to implement the changes have a say in what to teach to students at what level it is unlikely that the innovation will be implemented with fidelity and enthusiasm. Classroom teachers' role and co-operation in the implementation of computer education have serious implication for teaching and

learning. Parr (1999:280) suggests that teachers need to be "involved in decisions about the place of information technology in the school in order to define their own objectives."

3.2.7 Commitment by the school authority to the use of computers in teaching

Curriculum or computer technology implementation in any school needs support and commitment from the school administration. Supportive leadership from the school authority remains essential in overcoming the fears and negative attitudes of teachers towards the use of technology. Even though teachers act alone in classroom teaching, they need inspiration and support from the Principal and Heads of Department. The Principal needs to provide funds to purchase the necessary materials, and to encourage teachers by helping them to attend seminars, workshops and training in order to obtain relevant information on technology.

The Principal also needs to provide suitable facilities for effective use of the computers (Parr, 1999). A study by Yee (2000: 291) found that the Principals portrayed a passionate commitment to providing appropriate ICT (computers) professional development support for their staff members. Yee (2000) noted that "each Principal was a very skilful entrepreneur who used a carefully constructed social network to locate creative sources of ICT (computer) hardware, software and expertise." Such commitments encouraged teachers to implement computer technology in teaching and learning. But if the style of administration within the school exerted no effort for computer technology implementation, very little will be done by the staff. Effective computer education development requires Principals to provide strong leadership support as reported by one Principal in the study by Yee (2000) "The teachers believe it is my job to find ways for us to do things (with ICT). I never take no for an answer….even if I run into a dead end. If it's really important to us, they know I'll make it happen."

3.2.8 Commitment by the government to the use of computers in schools

Computer education implementation in schools needs to be a government commitment for it to be achieved by all schools. If the government initiates computer programs, there is need to provide schools with necessary resources and to spell out clearly to the teachers how the program is to be implemented. There is need for

constant consultation, exchange of ideas that will encourage teachers' participation, and communication when they are faced with any major problem in curriculum innovation. This will ease the implementation of computers without any major difficulty. Coles, Richardson, Wilson, and Tuson (2000:167) gave an example of the Department for Education and Employment in Britain that increased the number of computers in schools and provided basic training in computers for practising teachers that reflected a commitment by the UK Government to integrate computers into teaching and learning. Pearson (2001:179-290) also reports similar commitment by the Hong Kong Government to computer education in all schools. Pearson noted that each primary school was to be supplied with 40 computers and each secondary school was to receive 82 computers. In addition teachers were to be trained and resources provided to teachers. However, it is not clear whether availability of computers in these countries and training of teachers resulted in the successful implementation of computers in teaching and learning. Research studies reported by Clark (2000); Albion (2001); Crawford (2000); Opie and Katsu (2000) and (Coutts and Drinkwater 2001) indicate that very few teachers use computers in teaching and learning. These scholars reported lack of resources, lack of teachers' commitment, and lack of proper training in the use of computers.

3.3 Factors that affect the use of computers in teaching and learning

Just as there are many factors that encourage the introduction and use of computer technology in education, there are also several factors perceived by teachers using computers as hindering the use of computers in schools. Some of these factors are teacher related others are concerned with the school administration and the government at large.

3.3.1 Lack of teachers' preparation to integrate and use computers in teaching

If the integration and use of computer technology in the classroom is to be effective, the inherent problems of teachers need to be examined so that a possible solution could be found. Otherwise schools will continue to face the inadequate utilization of computers for instruction. Teachers are the backbone in any curriculum innovation. They have a central role in integrating computers into schools. Therefore they must be trained properly in the use and integration of technology into the curriculum. Well-

trained teachers are the foundation of effective curriculum instruction. An effective strategy would be to concentrate effort on initial training through pre-service and in-service course programmes in computing skills.

Research conducted in developed countries like America, Australia and in Britain indicates that there are not many teachers qualified to use and integrate computers into teaching (Albion, 2001; Clark, 2000; Coutts and Drinkwater, 2001; Crawford, 2000; Opie and Katsu 2000; and Parr, 1999). These scholars reported that most of IT teachers were not qualified in the subject and the quality of teaching computers was not up–to- date. Coutts and Drinkwater (2001:227) noted that teachers lacked the knowledge or skills that would allow them to integrate computers into the classroom learning or to think about how ICT could be used to transform learning and teaching. Therefore, despite the pressure on teachers to increase the use of technology in education, progress towards integrating computers into the curriculum and subsequent widespread use in the classroom remains limited (Abbott, 2000 and Young, 2000).

Consequently, the success of integrating computers in education in developed and developing countries like Kenya depends strongly on how teachers have been prepared to use computers. The inadequate training of teachers in the use of computers has been claimed to be a major factor affecting the integration and effective utilization of computers in teaching and learning. Many studies have therefore, argued that in order to integrate and use computers in the classroom, all teachers should be trained in their use (Clark, 2000; Ranae and Troy, 1999 and Cameroon 1999). A study by Macaro and Erler (1998:89) carried out at the University of Reading in England reported complaints from the participants that "gaining experience and confidence, particularly in the use of computers and software was seen as the main current deficit in the use of computers in schools." Moreover, another study by Chiero (1997:135) found that lack of training was a problem frequently mentioned by teachers as the second highest obstacle to the integration of computers into teaching. Scheffler and Logan (1998:308) also noted that "teachers' lack of confidence in their computer skills and their ability to integrate computers into the classroom hampers effective computer implementation." In addition, Carol (1997:57) found that "teachers needed to be trained not only in personal computing skills but in the practical application of the skills, for example in the incorporation of a computer

into classroom use, in planning and in preparing schemes of work." Similarly, Abbott and Faris (2000:150) argued that the amount of computer experience provided to students during their training might affect the extent to which they will implement technology in their own teaching.

Nevertheless, Kay, Caffarella, and Tharp (1999) report the results of a case study that investigated the use and integration of educational technologies within pre-service education. Kay, et al. (1999) noted that teachers needed to be trained to change their role and responsibility from the "dispenser of knowledge to facilitators of knowledge acquisition to manager of information resources." Kay, et al. (1999) identified the inadequacy of pre-service course program that hindered the effective utilization of educational technology in the classrooms such as time, expertise, accessibility to equipment, resources and support materials. Kay et al. (1999) were convinced that if properly trained, the power of technology lies in the teachers' ability to appropriately select, integrate and evaluate computer tools to support learning. They gave an example of a way to integrate and use computers that required students to create "Hyper studio" and practice how to use the technology. This illustrated an important issue in the implementation of computers into teaching and learning, namely, the teachers' attitude and beliefs about the technology. When teachers develop confidence in using the technology, they will act more as facilitators by helping students access information, process it and communicate their findings (Dexter, Anderson, and Becker, 1998).

Effective teacher training in the use of computers has also been found to be very valuable to beginning teachers. A report by Stetson and Bagwell (1999) indicated the need to train teachers in the effective use and integration of technology. This will enable them to develop confidence to use computers at their own time, to feel comfortable and to have the ability to use technology successfully. The results of this report demonstrated clearly that if teachers are trained to use computers and to integrate them into their schemes of work and lesson plans then this might influence them to integrate technology into classroom instruction. Although training institutions in developing countries may not be well equipped to provide effective training in the use of computers an alternative approach should be devised. This could be offered through a general course in computer skills followed by special training at subject

level. In addition, it might be necessary to have an effective in-service course programme either at school level or at various centres to strengthen the pre-service course programme and to continue assisting serving teachers to integrate and use the computers.

One problem with the integration of technology, not only computers but even with media like audio and video, is that serving teachers' attitudes or beliefs towards the technology in some schools are not supportive. Most teachers are reluctant to employ them in teaching once they qualify from training institutions, so the newly trained teachers posted to such schools also tend to do the same. Young (1999:280) noted the problem and argued that "teachers often resists new technology partly because, they did not feel confident to use it." They also did not see its relevance for improving the teaching and learning process, and some teachers gave lack of quality software in their subject area as the reason for not using computers. Therefore, it can be argued that teachers need good programs of high standard, something new and special that will motivate them to use computer technology. They also need support and training to positively integrate computers into their classrooms. These training programmes must not be designed just to improve their skills with computers but should also aim to help them to change their attitude towards the use of instructional computer technology (Clark, 2000:182).

3.3.1.1 The training of teachers to integrate computers into teaching subjects

As schools introduce computer technology into teaching and learning, teachers must learn how to integrate computers into their curriculum and instructional strategies. Since hardware and software are changing rapidly, teachers need to be taught both computer skills and skills in designing and implementing curricula using computers. Tiene and Ingram (2001:254-255) report that as schools become wired and acquire a wide range of equipment, teachers will have to be able to make good use of e-mail, web browsers, databases, spreadsheets, word processor etc. Teachers must gain new and improved skills in using these technologies. Teachers need to know how to integrate computer technologies into their teaching subjects. Tiene and Ingram (2001) add that teachers need to be conversant with hardware and software. They report that computers have new capabilities and new requirements. For example "new input and

output devices such as scanners, cameras, and printers will require set up, basic trouble shooting and competent use." All these new developments in computer technology require training. Heinich, Molenda, Russell and Smaldino (2002:313-314) feel that teachers need to be trained to understand that their role has changed from information presenter to learning resources co-ordinator, and to serve as facilitators, managers, counsellors and motivator. They believe that training will enable teachers to learn that " their new role frees them to work more independently with individuals and small groups while computers do the formal lesson presentations." Therefore, training teachers in computer integration should be approached through pre-service training, in-service or in house training or workshops.

3.3.1.2 Pre-service teacher training course in computer-integrated education

Many formal pre-service courses have been often offered. Yet the feeling often expressed within the profession in developed countries is that it is not enough and often not of the right character (Crook, 1994; Coutts and Drinkwater, 2001; Vanatta and Beyerbach, 2000). The opportunities for teachers to gain confidence with the new technology across the period of initial training are often limited. There is need for students to be trained to integrate technology into their teaching subjects and practice using it during teaching practice. Many teachers have only superficial pre-service exposure to new technology by the time they complete training. Research on teacher preparation at pre-service course indicates that many students-teachers have not been properly trained to integrate and use computers. According to Vannatta and Beyerbach (2000: 145), a technology course on basic skills does not adequately prepare pre-service teachers to constructively integrate computers into their future classroom. Teacher education programs must therefore be designed to prepare students to move to their classrooms with confidence to integrate and use computers, and this will require more than just a basic literacy course. Preparation of teachers on the use of computers should also be a continuous process, through school-based training and in-service course programme. This can be achieved through retraining courses and workshops or seminars.

3.3.1.3 In-service teacher training on the use of computer-integrated education

Effective in-service training of teachers is essential to ensure successful implementation of computers in teaching and learning. It should aim to serve the needs of classroom teachers by updating their professional qualification, increasing their knowledge on various education issues and improving their classroom practices. In-service training helps teachers learn how to teach the skills of computer technology, and to keep them abreast of current development in the use of computers. Teachers must be adequately informed in the new specialised knowledge, and skills, and posses relevant competencies to use computers. Yet research findings indicates that in-service course programmes seemed to be inadequate for serving teachers (Carol, 1997; Crook, 1994).

Even in developed countries, in-service courses in the use of computers need to be intensified for classroom teachers. They should be given an opportunity to attend many short courses, not just a few. In-service provision can be a quick way to create an impact. However, the hope that those who receive training on intensive short courses will go back to their institutions and pass on their expertise to the rest of the staff members is not always realised. Hence the call for opportunities for many teachers to attend seminars and workshops organised at school level to up-date their knowledge on the use of computers.

3.3.1.4 School-based workshops/seminars for serving teachers on computer integrated education

Organising workshops or seminars for teachers designed to extend their professional capabilities at school level would be an important step towards effective use of computers in schools. The need to provide school-based training geared towards the improvement of teachers' teaching techniques and general awareness of computer equipment used in teaching would benefit all the staff and students. It would also serve as an exhibition of computer equipment for people to learn and exchange ideas with computer experts (Nisan-Nelson, 2001: 89; Stetson and Bagwell, 1999). For example, Mccannon and Crews (2000:115) found that 97% respondents in their study had been offered staff development courses in computers, and 54% participated in word processing training. They also reported that software staff development classes

included training in "Accelerated Reader, Writing to Write and Gradebook." The researchers noted that teachers benefited in word processing classes and were ranked as the most beneficial staff development classes by the majority of the respondents. They also found increased computer usage. Ninety-two percent of the respondents indicated that their computer use increased after participating in computer staff development classes. In conclusion, the researchers noted that since computers is now being offered in teacher education programmes, administrators should use staff members with experience to train other teachers in computing. They believed that with right training, all teachers in a school could enhance their teaching with computers.

3.3.2 Attitudes of teachers towards computers in education

The success of any curriculum innovation depends on the attitudes of teachers towards the innovation. For example, when teachers were asked to implement the Outcome Based Education in South Africa, many teachers adopted a very negative attitude. They did not understand why they were being asked to change their approaches to teaching, so they resisted the changes (Jansen and Christie, 1999). Research has also shown that the attitude of teachers towards computers in education is an important factor in the effective integration and use of such computer technology in teaching and learning (Abas, 1995; Young, 2000). Attitude has been defined by Anandra (1998:284) to encompass various relationships, from simple like and dislike of computers to complex attitudes such as computer anxiety and apprehension. Therefore, one factor in the successful integration of computers in the school curriculum is teacher acceptance of the new technology. Teachers' acceptance is believed to depend on their attitudes towards the technology, since decisions about whether and how to employ the computer technology in teaching are heavily influenced by teachers' views and attitudes and by their perceptions of the value and benefits of computers in motivating students to learn. Having computers in the school will not mean that teachers will integrate them into their teaching subjects. However, previous computer integration experiences and use was one of the factors that significantly relate to more positive computer attitudes (Clark, 2000).

Furthermore, research has shown that teachers' attitudes about computers can positively or negatively influence their students' attitudes towards computers in

education and that low users of computers tend to have a more negative attitude towards computers (Anandra, 2000:292). Moreover, increasing amount of computer experience has been associated with positive attitudes towards computers (Abbott and Faris 2000:156). Similarly, research has indicated that attitude towards the use of computers is related to other attributes such as the relationship with gender. For example, a study by Comber, Colley, Hargreaves and Dorin (1997:123) in Britain found that male students from both age groups reported greater experience with computers and had more positive attitudes towards computers than female.

Thus, factors such as gender, amount of computer experiences, and beliefs matters a lot in the development of both positive and negative attitudes towards integrating computers in schools. To explore this issue, Young (2000:204-211) carried out a study of 462 middle high school students to provide more evidence on gender differences in attitudes towards the usefulness of computers for schools. The researcher examined factors such as confidence, perception of computers as a male domain, positive and negative teacher attitudes, and perceived usefulness of computers. The main objective of the study was to examine the patterns of gender differences in the use of computers. A total of 48 attitude questions rated on a 5-point Likert scale type-response format was used. In addition, ten background questions were designed and administered to 220 girls and 242 boys to determine gender access to computers on a weekly basis. The overall results showed that male students were more confident with computers than girls but the girls rejected the claim that computer were a male domain. Comber et al. (1997) reported similar findings. Since attitudes can be modified or changed, it is expected that teachers and students may become more positive towards the use of computers once their attitudes are identified and steps are taken to challenge these attitudes if necessary. Based on the above research findings, teachers could develop negative attitudes towards computers due to lack of experience with the computer technology, lack of interest and lack of support from school administration.

3.3.3 Lack of computers for teachers to use in teaching and learning

In order to integrate computers into the school curriculum, there is need for all schools to have an adequate supply of computers and other related resources. It is difficult to define what might be necessary as an "adequate" level of computing

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equipment in a classroom because it will depend very much on how the computers are to be used by the teachers and the students. If the teacher is going to use the computer to demonstrate things to students then one computer might be enough. If students are to work on the computers themselves, then maybe they need one computer for each student. Certainly, when students are trying to learn how to use computers (e.g. for word processing) it is very difficult if they do not each have a computer. Effective use of computers in teaching and learning in the classroom requires sufficient availability of computers, software and support materials such as textbooks, students manuals and teachers guide notes.

Research findings have indicted that lack of equipment was a major barrier to the effective integration and use of computers in the classroom (Carol, 1997; Mellon, 1999; Peggy, 1999 and Zammit, 1992). A study by Ertmer, Addision, Lane, Ross and Woods (1999:66) confirmed that lack of equipment was a barrier to the integration and use of computers in the classroom. Other findings indicated that teachers in the study wanted more computers so that they could get the groups involved in working at the same time. They needed "enough computers for at least six to eight kids to work on it." One teacher argued that "one computer is basically worthless with the way I organise my room I need enough for a small group." Another said "having more computers would let me do more of what we are doing but do it more efficiently." In conclusion, Ertmer et al. (1999) noted that lack of equipment held different meaning for these teachers and affected what they accomplished with current resources in different ways.

In addition, lack of availability of software and other support materials such as teachers' guide notes and students' manuals have been reported as another factor affecting the use of computers. Carol (1997:55) study found that the "use of computer was often linked to availability of software for the particular topic being covered." She further noted that teachers wanted to be made aware of the availability of software and its potential for real enhancement of language learning along with guidance on how to assess its contribution in the classroom.

Zammit (1992:59) also found that 'software availability' encouraged teachers to start using the technology. Zammit noted that teachers were often disappointed by the quality of the software that was found to be pedagogically weak or inappropriate. The

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study revealed that teachers were looking for software that fitted into their curriculum and that extend the work done in class. Therefore, effective integration and use of computers in educational setting lies in the way in which teachers are enlightened about the software tool and its possible use in their teaching. Therefore, lack of dissemination of information on the availability of equipment and all the necessary support materials and quality software relevant to the curriculum, will probably mean that the integration and use of computers in teaching and learning cannot be fully effective. In fact the resources must be available in sufficient quantity to help teachers in advance planning and lesson presentation (Becker and Ravitz, 1999). The problem of availability of technology has continued to affect the use and integration of computers in the classroom. A recent study by Vannatta and Beyerbach (2000:150) found that technology infusion in the curriculum was still difficult to implement in American schools because of inadequate equipment and software. There is need for the stakeholders to plan and provide adequate funds to be set aside for the purchase of technology so that teachers and could use them as required.

3.3.4 Accessibility of computers and resources for teaching and learning

Collins dictionary defines access as "the state or condition of being approachable or easy to enter" and the second one refers to access as "the right or privilege to approach, reach, enter or make use of something." These definitions fit very well with the concept of "access" to computers meaning the opportunities afforded to all students and teachers to interact with computers and to the removal of barriers that might stand in the way of these opportunities being taken up. The issue of access to technology and software is vital in the effective utilization of computers into education. Clark (2000) and Millar (1997) noted difficulties in access to technology that have resulted in low levels of computer utilization. In fact access to computers for integration and use in teaching and learning stands out prominently and remains a big challenge even in developed countries.

Given the relative high cost of computers, access to computers tends to favour wealthy schools and students. For example, a study by Barron, Hogarty, Kromrey, and Lenkway (1999) in Florida State in America shows exactly how rich countries can afford large number of computers. The study indicated that more computers were supplied to schools to help fight the high rate of crime and poor behaviour of students.

In addition, Clark (2000) reported that in the USA the report by the Office of Technology Assessment (OTA 1995) estimated that the number of computers in K-12 schools increased by 300,000 to 400,000 per year in the 1980s. Nevertheless, even with this large number of computers in the USA there are still problems of access. Strudler (1996:255) found that lack of access to computers and software was a major impediment to technology integration. In a nutshell, I can say that the extent to which teachers and students can use computers in teaching and learning depends to a very large extent upon how accessible the technology is to them when they want to use it with the students. Again, even if the computers were available to the teachers, there is also the issue of timetabling and booking the computer lab that has to be done in advance (Carol, 1997:52). Besides, as Carol (1997) noted, access to technology does not just mean obtaining a computer, but it includes getting it and using it as required. Therefore, access to computers is a major issue in both developed and developing countries. The school can purchase many computers "to support teaching, but if students cannot access the technology, all the investment is wasted" (Bates, 2000:85). Thus, with easy access to resources and adequate information about them, teachers could be sufficiently motivated to use them. Moreover, access is also a function of the teacher's knowledge and skill-a teacher could have several computers in the classroom, but if he/she does not know how to use them the technology is not "accessible."

3.3.5 Technical support for effective use of computer in schools

The issue of technical support and maintenance of educational technology equipment is one of the major factors militating against the integration of computers in the school curriculum, especially in developing country like Kenya. A decision to include computers in teaching and learning must consider the maintenance. There is also need to consider whether the performance of the computers will be maintained under normal working conditions and whether the equipment is reliable or not. The problem posed by heat, humidity, dust, and access to electricity to use computers poses some of the problems faced by developing countries with poor electrical supply. It is also important to find out if the type of technology to be purchased can easily be repaired by the local technicians. For example, donation of certain types of computers from the industrialized world to developing countries raises the questions of where to get spare

parts should such equipment need them. Because after donating the equipment, the maintenance work is left in the hands of the school with no technician around. As a result, some of the computers donated to schools have been rendered in-serviceable and become obsolete (Report from my students during media lectures 2000).

However, even in developed countries, the issue of technical support and maintenance of computers has been reported by researchers, though computers are used in an environment where maintenance and use of infrastructures are well developed and market services are available. Veen (1996:177) reporting on the situation in Netherland noted that "the support of the technical assistant is essential for teachers." Veen (1996) believes that teachers count on the support of the technicians for tasks such as use of software and in collaborative work during the lesson in the laboratory. Similarly, Carol (1997:56) found that the support provided by technical assistants and co-ordinators were very valuable to teachers. The participants in her study in England reported that coordinators provided helps in "trouble shooting with machinery and software, organising departmental access to computers, supporting bids, installing software and advice on specific software." Furthermore, Carol (1997) found that some schools had computer technicians permanently based in the computer room to help teachers and students. Similar findings on technical support have been reported by (Andris, 1996; Chiero, 1997). Availability of technical support would be an ideal help for integration and use of computers in schools in Nyanza province, but due to lack of funds this could still be a problem. Schools with computers might need to organise fund raising to employ even part-time technicians.

3.3.6 Lack of adequate time to use computers in teaching and learning

Researchers indicate that lack of time for teachers and students to use computers effectively in teaching and learning is another factor that inhibits effective use of computers in the classroom (Andris, 1996; Chiero, 1997 and Struddler, 1996). For example, Strudler (1996), pointed out that the participants in his study complained of being burdened with teaching load and planning duties and other school work such that they had no time to learn, to keep up with and plan to use the new software. At the same time, Chiero (1997:138) found that 82% of the respondents in her research had no time to learn and use computers. At the same time, Ertmer et al. (1999) pointed out that time was a barrier that affected motivated teachers' efforts to use

computers in teaching and learning. For example, time was wasted if students had to move from their normal classroom to a special computer room. Furthermore, Ertmer et al. (1999:66) found that "lack of time was interpreted differently by different teachers depending on classroom practices and beliefs about the role of computers in teaching and learning." One of the participants in her study saw time as a barrier in relation to the need to learn new software and the desire to have children create products on their computers. Karen, (1999) and Struddler (1999) report similar findings. However, the problem of lack of time may come about due to lack of time management skills. If teachers plan their daily work in advance and make time available for each important school activity, then there could be plenty of time to incorporate technology in teaching. Teachers who are committed to their work will always find time to incorporate computers in their teaching. They can also store the required teaching/learning notes in computers and make arrangements with the students to access them at their own free time. Teachers could as well devise methods of team teaching in order to share the time available for computer lessons. Rice, Wilson and Bagley (2001:218-219) report on the research finding of a teacher who made an effort to overcome the barriers to the use of computers in teaching and learning despite discouragement by the Principal. They report that the teacher's interest in technology and his belief that students would need technological skills in the future, made him willing to spend much of his own time outside of school to learn technology. The teacher also made an effort to look for funds and studied ways to use the computers within his curriculum. Similarly, Mcrobbie and Thomas (2000:137-180) discuss how a chemistry teacher "Anne" collaborated with the head of science regarding the introduction of MBL technology into the school's Chemistry laboratories for use in experimental work and prepared her own teaching materials. It seems that teachers who are motivated to do so can find time to integrate computers into their teaching.

3.4 Other factors to be considered in the use of computers in education

3.4.1 The use of computers to motivate students to learn

According to Heinich, Molenda, Russell and Smaldino (2002:363), motivation is an internal state that leads people to choose to pursue certain goals and experiences. Many researchers (Christman, Budgett and Lucking, 1997; Carol, (1997) have found

that motivational factors are indisputably important in education. Heinich, Molenda, Russell, and Smaldino, (2002:58) report that "various emotional factors have been found to influence what we pay attention to, how long we pay attention, how much effort we invest in learning, and how feelings may interfere with learning." In classroom teaching, for example, lack of motivation is a barrier to effective learning. Many students do not perform well in school subjects due to lack of interest and end-up dropping out of school. Therefore, if teachers can create an enduring fascination for the subjects under discussion, then students can learn more effectively. Heinich et al. (2002:58) report that "researchers have found that intrinsic motivators are generally more effective. Students who are intrinsically motivated will work harder to learn more because of their personal interest in the materials." The studies reviewed earlier, Carol (1997); Christman, Budget and Lucking (1997), have suggested that the computer can be an ideal medium for developing such motivation. Furthermore, the motivational function of the computer has been considered an important factor in many computer-based instructional programs (Barron, Hogarty, Kromrey, Lenkway, 1997; and Johnson, 1996). These studies show that intrinsic features of the computer such as immediate feedback, animation, sound, active interaction, and individualization are more likely than any other media to motivate students to learn.

At the same time, a study by Johnson (1996:79) found that computers were good motivators that heightened students' interest and enjoyment and were also seen to have a positive effect upon the status of the subject. Furthermore, Christman, Badgett, and Lucking (1997:333) noted that computers provide opportunities for students to engage in self-directed learning activities, which can promote intrinsic academic motivation. Barron, et al. (1999) also found that in addition to motivation to learn, students experienced increased self-esteem and self-confidence when using computers. Similarly, Carol (1997:59) noted that several Heads of Department who took part in her study reported the benefits of the technology in terms of pupil motivation gained from the use of computers.

Motivation for learning is an essential factor in any meaningful instruction. If the use of computers in teaching and learning can help students to learn effectively then it is worth investing in computer education. The integration of computers in the curriculum can help to heighten students' motivation to learn and introduce them to

variety of new learning experiences. Motivation can also do much to increase students' interest thereby helping them to learn difficult subjects like science and mathematics. This can be emotionally stimulating as well as being intellectually rewarding and can encourage them to want to learn more. But the learners' own effort to learn is very important. Mellon (1999:31) points out that "no matter how much technology is available, no matter how well it is integrated into instructional content, it is the learners willingness or ability to learn that is paramount.

3.4.2 The cost of using computers in teaching and learning

The cost of purchasing and operating computers in schools is the main reason why computers have not been widely used in developing countries like Kenya. But even in developed countries like America the infusion of technology into education and integration to all schools has been difficult due to lack of enough funds to provide computers to each student. Costs are difficult to estimate. The use of computers has been consuming a large proportion of the annual budgetary allocation in developed and developing countries with an aim that their use would improve the cost-effectiveness of methods of teaching. What then are some of the costs involved in the integration and use of computers in the classroom?

A study by Clark (2000) found that lack of funds was one of the major factors affecting the integration of computers into teaching and learning. There have been a number of attempts to estimate the costs of using computers in teaching and learning. One such attempt by Sheffler and Logan (1998:306) concluded that the "cost for technology extend well beyond the purchase and installation of hardware and software." Sheffler and Logan (1998) believe that technology training and professional development for teachers is part of the cost. According to them the training programme must be an on-going process, and this can be expected to require 30% or more of the school budget. They also feel that "teacher preparation technology course should be based on competencies essential for designing, developing, delivering, managing and evaluating instruction," that will also require additional funding. In addition, from my own experience, the cost of integrating and using technology also includes purchase of textbooks, students' manuals, teachers' travel to and from in-service training centres, maintenance and repair, electricity supply, and recurrent expenditures

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In Kenya, Eshiwani (1997:23) noted that the introduction of computer education in secondary schools is too expensive for most Kenyan parents. It means therefore that only a few financially capable private and National schools will be able to acquire and integrate computers in education. The issue of funding computer technology in education in developing countries is a big problem because budgetary data are often inadequate for a detailed study of costs that sometimes could be immense. For example, Barron, et al. (1999:98) report that a total of 4.8 billion has been spent to integrate technology into K-12 schools in Florida State in USA. It is not clear whether this figure include training of teachers or just for the purchase of computers and software. Besides, Carol (1997:58) studies in England found that funding for the integration of computers in teaching was a major issue particularly with the provision of commercial software that are not good value for money. Therefore, the problem of expenditure on educational computing is not unique to one country, so schools need to find other sources of funding the integration and use of computers in addition to funding from the government.

3.4.3 The cost-effectiveness of the use of computers in teaching and learning

Despite the high cost of integration and use of computers in teaching and learning, it is believed that computers can be a cost-effective way of teaching some things, but not all things (Christman, Budgett, and Lucking 1997; Herman 1995; and Klees 1995). According to research by Karen (1999), the use of computers fosters the use of more student-centred learning strategies. This is learning by doing that encourages creativity and thinking skills, the learners are able to recall what they learn from computers and improve their communication skills.

There is also some evidence that computers improve students' achievements through increased instructional quality and productivity (Mills and Ragan 2000). Research on CAI indicated that students "receiving traditional instruction supplemented with CAI attained higher academic achievement than did 57.2% of those taught through traditional method" (Christmann, Budgett and Lucking, 1977:328). Moreover, computer delivered instruction has the capacity for motivating learners, thus helping to improve learning of different subjects compared to than traditional approaches. Using computer allows students to enjoy being actively engaged and being able to

make mistakes without embarrassment and computers give students the feeling of being in control. Students persist in tasks requiring higher-order thinking skills as they work with computers and their self-esteem increased tremendously.

Recent research by Clark (2000:189) in the United States of America confirmed cost-effectiveness of the use of computers in teaching and learning. According to Clark (2000), it was reported by one of the teachers in his study that students were motivated to practice and review skills on the computer. The teacher also noted that students often create their own products on the computer, were exited and proud of what they could produce using the computer. The teacher confirmed that the use of computer helped to improve students' learning of various subject topics such as sciences, mathematics, languages, geometry, and helped to increase students' academic performance.

Although the use of computers in teaching and learning has been regarded as cost-effective in developed countries, it should also be an important issue to be considered in developing countries like Kenya that have very limited budget for education. There is need for further investigation to examine if the use of computers could also be cost-effective in schools in Kenya. If it is cost-effective, then developing countries should spend money to provide computing education. If it is not cost-effective (as compared with other media such as radio programmes, video programmes and other visual media) then perhaps it is very unwise for developing countries to invest heavily in computer education in schools

3.4.4 Support from the school for the use of computers in teaching and learning

Another factor that influences integration and use of computers in teaching and learning is the support from the school administration. The scope and mode of integration and use computers relies heavily on the head of the school. The part played by the head of the institution in the whole school policy on the use of educational technology helps to determine effectiveness, efficiency and shape the manner in which computers are integrated and used in the school. The Principle is the one who sets the ball rolling and formulates computer technology policy to be executed by departmental heads. The Principle is also the one responsible for providing funds for departmental heads to purchase resources for teachers to use in

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teaching. This is a major responsibility. Teachers need considerable support from whole school information technology and training to positively integrate computers into their classroom (Clark, 2000). Principals are therefore encouraged to work out modalities of supporting teachers to integrate and use computers, occasionally interacting with them in the lab and rewarding them. This will help to provide emotional support that teachers need to work effectively.

3.5 Summary

An attempt has been made to highlight those factors facilitating and affecting teachers' use and integration of computers into teaching and learning. The list is not exhaustive since the objective of my research is not on those aspects of the factors, and again, each factor would vary within different situations and in different countries. Only a few factor groupings have been discussed in relation to this study in Nyanza Province. The use and integration of computers in the classroom is strongly influenced and determined by the beliefs and the skills of teachers. Teachers have a responsibility to make decisions concerning pedagogical approaches consistence with their beliefs and their skills. Hence their preparation in advance in computer skills would greatly increase their use of computers in teaching and learning. However, studies revealed that most of the teachers even in developed countries have not been adequately trained in computer education as part of their academic studies.

Another factor identified was the attitudes of teachers and the Principals towards computers. No matter how advanced the techniques or methods were employed, only through positive attitudes of both the administrators and teachers could the benefits of the technology be realised. Negative attitudes affect the use and integration of technology into curriculum instruction. Reports from the research reviewed indicated that the majority of both teachers and policy makers had positive attitudes towards the use of computers. Similarly, the basic conditions for successful teaching and learning with computers such as the availability of the equipment and suitable computer software for learning literacy skills, other support from the government and the parents were identified as major limitations to the effective use of technology.

Accessibility of equipment and software was also a very important factor noted to encourage the teachers to use computers. In fact, lack of access to equipment,

software, and other support materials were identified as a major obstacle to computer technology integration and use in teaching and learning. Moreover, lack of skills and confidence in handling technology places more constraints on teachers' use of computers. Studies reviewed indicated that reliability of technology was a major determinant of its acceptability in the classroom utilization. Many teachers lose interest as soon as they have problems with computers and regard it as a waste of time and an embarrassment in front of students. Every teacher needs direct classroom support as well as adequate technical support related to the use of computers in teaching and learning.

Time was another limiting factor reported by some scholars as a barrier to effective use of computers. Teachers complained that in order to make good use of technology, they needed time to learn, time to pre-view programs and prepare the lessons, time to plan ways of integrating computers into their class work and time to develop their expertise. In addition, motivational factors can have a positive or negative effect on students to learn with computers. Lack of motivation was noted as a barrier to effective learning. It interferes with students' attention and concentration during and after learning. Research showed that the use of computers in teaching and learning was quite motivating and stimulating to students to learn mathematics, science, communication skills and other computer literacy programmes.

The cost of purchasing technology was another barrier to the implementation and use of computers in schools, especially in developing countries. Although the integration and use of computers is believed to be an ideal medium of classroom instruction, its cost-effectiveness has not been fully realised.

Therefore, the infusion of technology in the curriculum and subsequent use in teaching and learning will continue to be difficult if the factors identified by researchers are not examined critically, more so in developing countries like Kenya that lack suitable classrooms and reliable sources of electricity. Effective integration and use of computers in the whole school requires full support of the school administration, backed by clear policy at all levels of education. Chapter 4 continues with the description of how researcher conducted the investigation and collected more information to provide evidence on the use of computers in secondary schools in

Nyanza Province and the problems encountered by the respondents in the use of computers in teaching and learning.