INTEGRATION OF INFORMATION AND COMMUNICATIONS TECHNOLOGY AS A TEACHING AND LEARNING RESOURCE IN PRIMARY TEACHER EDUCATION IN KENYA

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ABSTRACT

Kenya aspires to harness science, technology and innovations in order to be competitive both regionally and globally. This can be achieved more effectively if learners in teacher education training institutions are developed into critical citizens of the digital world. Teachers should be prepared to use information and communication technology (ICT) as a teaching and learning resource. An innovation in education that is not backed by the teacher is bound to fail. Therefore, the main concern of this paper was to investigate whether primary school teachers in Kenya were prepared during pre-service training to use ICT as a teaching and learning tool. Case study and content analysis methodologies were adopted. Data were gathered using questionnaires. It was found that the primary teacher education (PTE) syllabus and the teachers' guide were not designed to develop trainees' skills in the use of ICT as a teaching and learning resource, and that the computer literacy skills of the tutors and the trainees were low. It is recommended that the PTE syllabus should be revised, and ICT be treated as a teaching and learning resource. Both tutors and students should be equipped with computer literacy skills, and the skills to use the computer as a teaching and learning resource.

Key words: information and communications technology (ICT), primary teacher education (PTE), integration, technology, education, digital world, teaching, learning, knowledge, skills, knowledge construction, curriculum

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INTRODUCTION

Kenya aspires to scale up its economy and provide a high quality of life for all citizens, as spelt out in the Kenya Vision 2030, which is the country's blueprint for the next decade. The country, according to the Kenya Vision 2030, intends to harness science, technology and innovations for regional and global competitiveness (Republic of Kenya, 2007). The vision also emphasises a Knowledge-Based Economy (KBE) and advocates for the application of science, technology, innovation (STI), and knowledge-based skills that call for the development of expertise in the construction of knowledge, creativity and innovation. The jubilee government proposed to initiate a project to introduce the use of laptops in learning, right from primary school class one, as of January 2014. The success of any educational innovation depends on teachers' readiness to implement the reform (Desimone, 2009). A critical stage in any innovation should be teacher preparation, in order to equip the teacher with the knowledge and skills required for improved instructional and learning outcomes (Kenya Institute of Education [KIE], 2002; Darling-Hammond, 1999).

There have been initiatives in Kenya such as the digitisation of school syllabi by the Kenya Institute of Curriculum Development (KICD). In 2009 the KICD launched the first phase of a curriculum digitisation project aimed at enabling both public primary and secondary schools to start offering e-learning (Okuttah, 2013). A teacher preparation programme that would have run parallel with both e-learning and laptop initiatives would have been ideal. Teachers should also have been prepared for these initiatives during their pre-service training. The KICD also developed information and communications technology (ICT) curricula for primary teacher education in 2004 (Ministry of Education, Science and Technology [MOEST], 2004) and a teachers' guide in 2005.

This study sought to establish whether the curricula developed for primary teacher education in 2004 and the teachers' guide developed in 2005 were organised in a manner that was suitable to prepare the student teachers in primary teacher training colleges to use ICT as a teaching and learning resource. There were reports of poor learning outcomes at primary level (Kenya National Examinations Council [KNEC], 2010) wherein the student teachers were to work after graguation. There were also allegations that the use of teaching and learning resources at primary schools was poor (Kisirkoi, 2012). There were many claims that ICT can and should provide rich, interactive teaching and learning resources that improve instructional and learning outcomes (Bitner & Bitner, 2002), which would serve well in the innovations.

Primary teacher education in Kenya and information and communications technology

The majority of primary school teachers in Kenya are trained in primary teacher training colleges, where they take a two-year residential certificate course. They are trained by teachers who are Bachelor of Education recipients, and who are trained to teach in secondary schools, with no preparation for teacher training. The Kenyan vision to harness science, technology and innovations for regional and global competitiveness would be achieved more effectively if trainees in teacher education institutions were developed into critical citizens of the digital world, wherein an understanding of technology is crucial. All teachers should be prepared to use ICT as a teaching and learning resource in learner-centered teaching and learning approaches, in order to enhance learners' innovativeness and knowledge construction when they practice teaching.

Constructivists contend that learning experiences should be authentic and should produce real-world learning environments that allow the learners to construct their own knowledge (Duffy & Jonassen, 1992), rather than make learners mere knowledge recipients. Construction of knowledge is an approach possible with the use of ICT. The student teachers at pre-service level would need to be equipped with ICT skills to be used in classroom teaching, presented as a teaching and learning resource. The student teahers would use the ICT integration skills they acquired in college when they start teaching, and also in their daily activities, integrated seamlessly. Training of teachers to use ICT as a teaching and learning tool is critical for teacher training at all levels.

Integration of information and communications technology in curricula

Integration of ICT in curricula entails the use of ICT to facilitate classroom instruction, where the basic requirements include computer literacy and the ability to use the computer and other ICTs to enhance classroom teaching and learning. The teacher requires a thorough understanding of the content to be able to break it down and design ICT-supported teaching and learning resources. Use of ICT as a teaching and learning resource to support learners' learning has been found to increase learning outcomes significantly (Bitner & Bitner, 2002). Among its many other benefits, ICT caters for varied learning styles and individual learning differences. It addresses different learners' senses, allows knowledge construction, engages the learner, makes learning learner-centred and eases the heavy teaching and learning data management

load. Technology supports the learning of all categories of learners, including those with special needs and those who are gifted or especially talented.

Kenya recognises the great role ICT plays in enhancing learning. However, the problem is that Kenya claims to have digitised primary and secondary curricula despite the fact that teachers in most schools have shown signs of ignorance regarding the use of ICT as a teaching and learning resource. Others have been reported to lack computer skills, face challenges of technophobia, lack electricity, and also face computer shortages and insufficient troubleshooting skills (KIE, 2005). These allegations threaten the proposed projects for the use of laptops and e-learning, and called for investigation.

Modern technologies, such as the computer and the internet, present some of the richest teaching and learning resources available. The current trend in education has made the Kenya Ministry of Education advocate for the seamless integration of technology into education for effective instruction and management of learning. ICT in education is useful for several purposes, such as enhanced classroom instruction and effective management of students' records. Modern technology, such as the computer, could be used by teachers to process their students' assessment results. For example, a computer would allow a teacher to work out (from raw data) the percentages, ranking, grading and Z-scores for a test quickly and effortlessly. Computers can also be used to create instructional materials or to locate ready-made educational resources on the internet for use in instruction. Technology also allows the development and enhancement of learner creativity and innovation by making learning interactive. This makes the educational process learner friendly, and enhances problem posing, problem solving and the development of critical thinking skills.

Technology supports the constructivists' view that learning experiences should be authentic and produce real-world learning environments that allow learners to construct their own knowledge (Duffy & Jonassen, 1992). The internet allows interconnectivity and eases communication through the use of lists on servers to send bulk emails; it facilitates discussions, conferences and chats on topical educational issues and in e-learning. It increases learner achievement, raises creativity, innovation, motivation and enthusiasm. Students receive immediate feedback and also receive individualised instruction.

Technology can be used to show laboratory experiments in scientific subjects such as Chemistry, Biology and Physics. Computer-aided learning can be used to teach subjects such as Literature, Geography, History and Mathematics. Multimedia

software provides learners (especially in subjects such as English) a rich linguistic learning environment that accommodates their needs by providing animations, videos and graphics to demonstrate difficult concepts as well as clear audio to model pronunciation (Duffy & Jonassen, 1992). Computer simulations and animations can be used to explain and illustrate difficult concepts and to make abstract knowledge concrete in very many subject areas (Bitner & Bitner, 2002). In Biology, cross pollination and germination of different seeds can be demonstrated. Computer games could be designed to improve learners' knowledge in areas such as spelling, or to test knowledge in other subjects and disciplines, and also for learners' enjoyment (Duffy & Jonassen, 1992).

In e-learning programmes, networked computers can facilitate interaction between learners and the teacher. Learners can ask and answer questions instantly so as to participate effectively in the learning process. The teacher could download materials from the internet, print and give them to the learners to work on; or if an internet connection is permanently available, upload them for use by learners in electronic form. The learners could also interact with the teacher and with each other. E-learning provides more extensive international collaboration opportunities for learners and teachers through web chatting, posting of assignments, online learner-to-learner chats and discussion fora (Bitner & Bitner, 2002).

STATEMENT OF THE PROBLEM

Kenya had planned to introduce laptops to primary school class one pupils from January 2014. In the Kenya Vision 2030, the country aspired to harness science, technology and innovations for regional and global competitiveness by the year 2030. The major issue of concern was whether teachers would be prepared to use ICT as a teaching and learning resource during pre-service. Other greater concerns were reports about the limited computer literacy levels of college tutors and of teachers in schools. In the revised primary teacher education syllabus (MOEST, 2004) ICT was introduced as a subject, but the issue of concern was whether it was organised and presented to teacher trainees as a teaching and learning resource. This necessitated investigation.

One way in which teachers could be thoroughly prepared to use ICT as a teaching and learning resource is to integrate it in the primary teacher training curriculum, presenting ICT as a teaching and learning resource during pre-service, and then conducting continuous teacher professional development for ongoing support of the teacher. The Kenya Institute of Curriculum Development (KICD) had digitised school

curricula from early 2000 and the project was launched in 2009. The KICD conducted an initiative to introduce e-learning to both primary and secondary schools (Okuttah, 2013). These commendable initiatives raised awareness and led to a desire to find out whether the college tutors and trainees, as the curriculum implementers and determinants of success of the educational innovation, were targeted for preparation.

In the KICD curriculum development process, teacher preparation is a critical stage, and since the institute started curriculum digitisation, it was expected that teacher training curricula should have been an initial target. The KICD had reported that plans were underway to train teachers at the initial stage of the laptop project, using a cascade model (Okuttah, 2013). The concern of this study was whether teacher trainees were prepared to implement the innovations. More specifically, it was not clear whether ICT was integrated in the primary teacher training colleges' curricula and in the teachers' guides, and therefore this study set out to establish whether or not this was the case.

OBJECTIVES OF THE STUDY

The objectives of the study were to:

- Investigate whether the pre-service primary teacher training syllabus and the ICT tutors' guidelines presented ICT courses as a teaching and learning resource
- Establish the computer literacy levels of computer tutors and trainees and their perception of the integration of ICT in curriculum
- Establish whether the teacher trainees were prepared to develop teaching and learning resources using ICT

MATERIALS AND METHODS

The methodologies employed were case study and document analysis. Questionnaires were used to collect data. Some verbatim utterances of teachers were also recorded unprocessed. One teacher training college out of the total 17 public primary teacher training colleges was studied in depth, and the issues focused on were contemporary and dealt mainly with answering the question 'How?' (Yin,2009). The syllabus documents and the guides used in primary teacher training colleges in Kenya were analysed. Questionnaires were used to gather data from the trainees and the tutors on how the curriculum was presented. A case-study approach was found to be appropriate as it allowed for a detailed study of a selected case critical to investigating the phenomenon under scrutiny (Creswell, 2009).

Document analysis was also employed. The documents analysed were used in all primary teacher training colleges, and hence were standardised. Kenyan primary teacher training colleges and schools follow a standardised curriculum, developed by the Kenya Institute of Curriculum Development. The curriculum is examined uniformly by the Kenya National Examinations Council (KNEC). Teachers who implement the curriculum are employed by one employer, the Teachers' Service Commission of Kenya (TSC), and the minimum qualification of a primary school teacher is a Primary Teacher Education Certificate. The implementation of the curriculum is supervised and monitored by the Quality Assurance and Standard Officers from the Ministry of Education (MOE). Teachers trained to teach in secondary schools train primary school teacher trainees, having had no induction to teacher preparation. Due to the stated standardisation, one college could safely be used to represent all others.

In this study, one teacher training college was selected for in-depth study. Data were collected from the trainees and the tutors from the selected college, to find out whether ICT was presented as a teaching and learning resource. The study of one primary teacher training college was found to be representative of educational experiences in the 17 other primary teacher training colleges in the country. The document analysis was also appropriate, because the syllabus and the teachers' guide, which needed to be studied to establish whether ICT was presented in a manner that would be likely to guide teachers to use ICT as a teaching and learning tool, were standardised. Questionnaires were used to gather data from the college tutors and the teacher trainees. The 2004 Primary Teacher Education syllabus, volume one (MOEST, 2004), which contains the ICT syllabus, was studied in order to establish its components and whether these present ICT objectives and content to prepare teacher trainees to use ICT as a teaching and learning tool. The teachers' guide developed in 2005 by the KICD to support the teacher in teaching ICT was also studied in order to establish whether it guided the teacher in approaching the ICT course as a teaching and learning resource.

TARGET POPULATION

The target population of the study was a total population of 500 student teachers and 20 tutors in the selected primary teacher training college. A total of 300 student teachers were in their first year and 200 were in their second year. There were 20 tutors in total, including one principal and one deputy principal. The summary of the target population is presented in Table 1.

Table 1: Target population

Type	1st year	2nd year	Total
Students/trainees	300	200	500
Teachers			20

Study sample

The study sample was selected from the target population. Students in the second year of the study were purposively selected to be used in the study because they had been in the college long enough to provide reliable data regarding their ICT experience in the college. They had studied ICT in their first year, and furthermore in their second year they were learning ICT as a core subject; hence they were familiar with the subject. A total of 20 student teachers from the second year group were randomly selected using simple random sampling. The one tutor of the ICT subject participated in the study and another five who taught other subjects in the college were selected, also using simple random sampling, making a total of six tutors who participated in the study. Table 2 presents the summary.

Table 2: Study sample

Type	1st year	2nd year	Total
Students/trainees	0	20	20
Teachers			6

The tutors and the teacher trainees filled in the questionnaires. The data were analysed and used to establish whether there was integration of ICT in teaching and learning. The findings were also used to establish whether ICT was used as a teaching and learning tool, and to investigate the tutors' and the trainees' computer literacy levels. In addition, the data were used to establish whether the teacher trainees facilitated the enhancement of teaching and learning resources using their acquired computer skills; a skill which, once acquired, they would in turn apply in their own teaching.

FINDINGS AND DISCUSSION

The findings of the study are presented as themes drawn from the study objectives.

Presentation of ICT course in PTE syllabus and teachers' guide

The ICT course was introduced in the latest revised primary teacher education syllabus in 2004 (MOEST, 2004). The topics for study are as follows:

First year: introduction to computers, computer systems, operating systems, maintaining and upgrading a computer, application systems and communication technology, application packages and word processing

Second year: spreadsheets, databases, graphics and presentation software, desktop publishing, the internet, data security and control

Each of the above is further broken down into sub-categories. The sub-categories under the topic 'the internet' are: definition of the internet; development of the internet; importance of the internet; internet connectivity; internet services; accessing the internet; electronic mail; moral, social and spiritual issues emerging from the internet; practical task.

There are no topics or subtopics presenting content and skills pertaining to preparation of the trainee to use ICT as a teaching and learning resource.

Specific objectives in a syllabus are expected to guide the college tutor regarding the scope and sequence of the content to be covered. The objectives also determine the strategies, methods and the teaching and learning resources the implementer will use. In a standardised curriculum, such as the one used in Kenyan primary teacher training colleges, the tutor cannot deviate from the standard. The specific objectives also determine the evaluation procedures. The specific objectives of the pre-service ICT teacher training course are listed below.

At the end of the topic the learner should be able to:

1. Define the term 'internet'
2. Explain the development of the internet
3. Explain the importance of the internet
4. Describe internet connectivity
5. Identify internet services
6. Access the internet
7. Use email facilities
8. State the moral, social and spiritual issues that may emerge due to the internet

The action words to guide the tutor and trainee are: define, explain, describe, identify, access, use, state. But the verbs do not guide either the trainee or the tutor in using ICT practically as a teaching and learning tool. It is only 'use' and 'access' that imply action but do not indicate 'how' ICT as a course is presented not as skill application but as knowledge acquisition. It has not been presented as a teaching and learning tool, and even the statements in which the outcomes are outlined are not clear. Clearly the objectives do not prepare student teachers to construct knowledge and use the computer practically as a teaching learning resource to enhance classroom teaching upon leaving college.

Syllabus content

The content of the syllabus that is intended to support the specific objectives is presented as follows:

1. Definition of the internet
2. Development of the internet
3. Importance of the internet
4. Internet connectivity
5. Telecommunication facilities – modems, internet providers, internet software
6. Internet services – email, world wide web, electronic commerce, electronic learning
7. Accessing the internet – log in, surf/browse, download information
8. Electronic mail – meaning of email, email software, requirements for connectivity

The content is only presented at knowledge acquisition level, rather than in a manner that prepares the trainees to use ICT as a teaching and learning tool. Trainees are required to absorb knowledge for examination purposes: they need to be able to name the parts of a computer and define concepts like the internet without necessarily being able to use or apply this knowledge.

The teachers' guide that was developed to support the ICT syllabus was also analysed to establish whether it guides the trainee to use ICT as a teaching and learning resource, and to develop teaching and learning resources using ICT. In the guide, the topics found in the syllabus have been re-organised according to sense and necessity. For example, the subject of the internet is brought to first-year level, because it is a resource that can be used for reference purposes, but the guide does not explain or illustrate how the internet can be used as a teaching and learning resource. The rest is a repetition of the syllabus, with some explanation of how to meet the objectives,

but these do not focus on guiding the teacher in the use of the internet as a teaching and learning resource.

The ICT guide treats integration as a topic on its own, but it does not clarify how to implement use of ICT as a teaching and learning resource. For example, the introduction to the guide reads as follows:

> Integration of ICT in education should help the teacher trainees adapt best practices in teaching and learning procedures and in daily lives. This topic gives insight into the perspective of ICT as a skill that should be applied in the teaching and meeting [of] learning objectives in other subjects in the curriculum. The teacher trainee should be guided to discover and understand the importance as well as the process of integrating ICT across the school curriculum. The student teachers should be clear about that *ICT integration in curriculum*. ICT integration in teaching of other subjects will ensure that that teaching and learning are more effective, efficient and interactive (KIE ICT Teachers' Guide, 2005: 12).

The specific objectives also do not guide the teacher in the use ICT as a teaching and learning resource. Examples follow below:

1. The objective that the learner should be able to 'use ICT as a tool for teaching' is too broad and unclear. The specific requirements to enable one to use ICT as a tool for teaching and learning need to be elucidated.
2. The objective that the learner should be able to 'select and install appropriate software packages' could be useful in ICT integration if it were practical and not theoretical. It is not clear how this will be achieved without provision of computers for the tutors and the student teachers. The expectation appears to be that it can be achieved theoretically.
3. The objective that the learner should be able to 'identify and use the right ICT tool and appropriate pedagogy in teaching different subjects' requires practice and, therefore, calls for ICT tools, knowledge and skills, and the right attitude. Teachers should first be made to appreciate the need to integrate ICT in education. They need wide exposure to ICT in its practical form. Teachers need to be enabled to change their attitudes and belief systems for the successful use of ICT in teaching to occur.

Practical tasks

The following practical tasks are provided for tutors, without guidance on their practical application:

1. Using a word-processing package to create templates that will help students to undertake a specified writing task
2. Setting up spreadsheets to help students explore relationships and patterns

The objectives in both the PTE syllabus and the teachers' guide are not aimed at preparing the learners to use ICT as a teaching and learning tool. The guide uses verbs in the statement of the objectives (i.e. define, explain, describe, identify, access, use, state) but offers no explanation. Instead, the guide prepares the student teacher only at the fundamental level: naming and defining the parts and functions of a computer. There is little material on how to actually use a computer and access the internet. Furthermore, teachers are not guided on the use of the teachers' guide itself in interpreting and implementing the syllabus as is expected.

Data were also collected to establish whether the syllabus and the teachers' guide have helped in using ICT as a teaching and learning resource. Tutors were asked whether the PTE syllabus and the ICT Guide cover ICT content and presents this as a teaching and learning resource. Table 3 provides a summary.

Table 3: Syllabus and ICT guide coverage of ICT content as a teaching and learning resource

Document	Very well covered	Well covered	Fairly well covered	Poorly covered	Not covered	Total
Syllabus	0%	0%	50%	3.3	46.7%	100
ICT Guide	0%	0%	2.7%	15%	82.3%	100

A large number (46.7%) of the tutors reported that the syllabus does not guide them in the use of ICT as a teaching and learning resource. The vast majority (82.3%) of the tutors believed that the ICT guide does not facilitate the use of ICT as a teaching and learning resource. It can be concluded that the syllabus and the guide are not preparing teachers to integrate ICT in teaching and learning.

Computer literacy levels of tutors and teacher trainees and their perception of ICT integration in the curriculum

Questionnaires were used to establish the computer literacy levels of the tutors and the teachers. One tutor's response is presented verbatim below (it was recorded for triangulation of findings):

> There used to be 15 computers, but there was poor maintenance and most of the times they were not working. In the course of time, they all disappeared. Two more were purchased. One is used by the ICT tutor and the teachers and the students use the other one.

There is only one ICT tutor in the college, and neither he nor the other tutors understand the concept of the integration of ICT in teaching and learning. Therefore, implementation and effective guidance of the trainees to use ICT in teaching and learning cannot be possible.

Table 4 presents a summary of computer literacy levels of the trainees and the tutors according to their own assessment of themselves.

Table 4: Computer literacy levels of tutors and trainees

Computer literacy	Literate	Moderately literate	Illiterate	Total
Tutors	10%	15%	75%	100
Trainees	5%	0%	95%	100

Most (75%) of the tutors reported that they are computer illiterate and could not assist the ICT tutor in use of ICT as a teaching and learning tool. The ICT tutor also cannot guide the tutors of other subject areas in the integration of ICT, as is required. The majority (95%) of the student teachers have no computer skills and imparting computer literacy skills to them would take a great deal of time and effort. The majority of the tutors and trainees are computer illiterate, making the possibility of ICT integration in instruction a challenge.

Tutors and students were asked the source of their computer skills and Table 5 presents their responses.

Table 5: Source of computer skills reported by the tutors and the students

Source of computer skills	Secondary school	Commercial college	Own tutorage	Total
Tutors	0%	50%	50%	100%
Students	13%	87%	0%	100%

Tutors were asked where they had learnt their computer skills and 50% reported that they had learnt in commercial computer colleges. An equal number had learnt on their own.

This shows that none of the tutors had learnt how to work with computers in school. A total of 87% of student teachers also reported that they learnt how to operate a computer in commercial places. Only 13% reported that they learnt to use the computer in secondary school. This information raises questions regarding the teaching of computer skills in schools, regardless of the fact that computer studies is offered as a subject in secondary schools. This scenario is in line with the 2013 report by Okuttah, as published in *The Daily Nation*. He reported that current statistics from the Ministry of Education indicate that less than 4% of public primary school learners have access to basic computer studies, and that only few public secondary schools have computers. This is a further indicator that the success hoped for by the KICD, in developing online courses for primary teacher orientation in curriculum interpretation and implementation, will be a great challenge.

Teacher trainees' preparation to develop teaching and learning resources using ICT

In most (90%) of the cases the student teachers had not grasped the concept of integration. The tutors did not use teaching and learning resources when teaching. One tutor reported to the researcher:

> We never manage to use teaching and learning resources in the course of teaching but we tell the student teachers how to prepare and use them. We find most of them using teaching and learning resources only during teaching practice.

The student teachers used teaching and learning resources mostly for teaching practice. Tutors did not generally use resources in teaching and hence they did not see the need to use ICT as a teaching and learning resource. They also argued that time was too short. The real reason for not taking ICT very seriously, as was reported by another tutor, was that the subject is not examined by the Kenya National

Examinations Council (KNEC). Therefore students were not motivated to excel and they argued that, after all, ICT is not taught in primary schools. One tutor confirmed this as follows:

> You see Madam, to tell you the truth, as long as ICT is not examinable by the Kenya National Examinations council, nobody will be serious with it.

Examinations tend to control teaching and the examination grade is seen as more important than the skill acquired.

CONCLUSION

The initiative to introduce ICT in primary teacher training colleges in Kenya is commendable, but it needs to be refocused if it is to develop the student teachers so that they are able to integrate ICT in instruction to enhance teaching and learning. The course as it is in the curriculum concentrates on development of ICT literacy skills and not the use of ICT as a tool to enhance teaching and learning. The course does not prepare teacher trainees for integrating ICT in the curriculum.

RECOMMENDATIONS

- The 2004 primary teacher education syllabus needs to be revised to target development of skills for ICT integration in instruction. A focused tutors' guide should be developed, to guide tutors in ICT integration.
- Teacher training curricula for all levels of education need to include a component on integration of ICT in the curriculum and in classroom instruction.
- As a practice, teacher preparation needs to reflect the dynamism in society, and as the society turns digital, teachers should adapt: teaching and learning resources need to be computer based.
- The college tutors' and student teachers' beliefs regarding ICT as a teaching resource and the role of resources in the creation of friendly, exciting learning environments needs to be addressed. Awareness needs to be created around the fact that resources play a big role in enhancing learning outcomes.

- The tutors in teacher training colleges and the teacher trainees need to be trained to acquire computer literacy skills first. They will then need to be prepared to use ICT as a teaching and learning resource. The teacher trainers need to be assisted in acquiring computer literacy as a first step. They must then be familiarised with the use of ICT as a teaching and learning tool for themselves before they can be expected to integrate ICT into the curriculum effectively. Tutors should not be allowed to train others until they are completely ready and appropriately qualified to do so.

- Tutors' and students' attitudes and beliefs regarding ICT as a subject that is not externally examined should be addressed. The tutors require induction in the use of ICT as a teaching and learning resource. They should be required to understand that computer skills acquisition is a form of empowerment. Besides its uses in teaching, it can enable them to streamline and simplify activities such as record keeping and administration (e.g. tabulation of test scores, giving students assignments, preparing teaching aids, assisting students with special needs). ICT can also be made use of in the development of critical thinking, knowledge construction and problem-solving skills. Curriculum implementers need to appreciate the fact that the computer and other multimedia devices could help in addressing learners' individual differences and their different learning styles. They could use animation and simulation to raise learner enthusiasm and motivation in class, which are important variables in teaching and learning.

- Teacher trainees and tutors should be prepared to develop teaching and learning resources using ICT in real-life situations, and to use them consistently in class.

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