Chapter 1
Research General Frame

1-1 Introduction

For developing countries ICTs (Information Communication Technology) have the potential for increasing access to and improving the relevance and quality of education. It thus represents a potentially equalizing strategy for developing countries. [ICTs] greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others who live in the poorest countries, is their sense of isolation. The new communications technologies promise to reduce that sense of isolation, and to open access to knowledge in ways unimaginable not long ago. However, the reality of the Digital Divide—the gap between those who have access to and control of technology and those who do not—means that the introduction and integration of ICTs at different levels and in various types of education will be a most challenging undertaking. Failure to meet the challenge would mean a further widening of the knowledge gap and the deepening of existing economic and social inequalities.

ICTs are a potentially powerful tool for extending educational opportunities, both formal and non-formal,to previously underserved constituencies—scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus. • Anytime, anywhere. One defining feature of ICTs is their ability to transcend time and space. ICTs make possible asynchronous learning, or learning characterized by a time lag between the delivery of instruction and its reception by learners. Online course

materials, for example, may be accessed 24 hours a day,7 days a week.ICT-based educational delivery (e.g.,educational programming broadcast over radio or television) also dispenses with the need for all learners and the instructor to be in one physical location. Additionally, certain types of ICT such as teleconferencing technologies, enable instruction to be received simultaneously by multiple, geographically dispersed learners (i.e., synchronous learning). • Access to remote learning resources. Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries (and available in limited quantities) for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at anytime of the day and by an unlimited number of people. This is particularly significant for many schools in developing countries, and even some in developed countries, that have limited and outdated library resources. ICTs also facilitate access to resource persons—mentors, experts, researchers, professionals, business leaders, and peers—all over the world

One of the most commonly cited reasons for using ICTs in the classroom has been to better prepare the current generation of students for a workplace where ICTs, particularly computers, the Internet and related technologies, are becoming more and more ubiquitous. Technological literacy, or the ability to use ICTs effectively and efficiently, is thus seen as representing a competitive edge in an increasingly globalizing job market.

Now, technology has been used in teaching in Sudanese schools, in this research the researcher is trying to find out the capability of Sudanese colleges and faculties of education to prepare well trained teachers to use ICT in secondary education.

1-2 Problem Statement:

The ICT (Information Communication Technology) policy for education in Sudan was launched in 2002(ICT4 Africa, 2006) and major private projects and initiatives assisted in introducing ICT in to schools (e.g. the program of Computer Integrated Education to teachers to use ICT in teaching and learning process, Educational Institutes" Programs for providing schools with computers, and the private companies for providing schools with computers software programs for secondary schools. A number of computers are installed in schools throughout the country's 26 states(before the separation of Southern Sudan), and the ICT curriculum has been introduced at secondary schools (learning about ICT) (ICT4Africa, 2006). (Abdurrahman, 2009).

Today, many Sudanese secondary schools (particularly the private ones) strive to integrate appropriate ICT tools into their classrooms. Despite the numerous investments in hardware, software, and supporting ICT resources, little is known about implementation, in addition, it seems that teacher training is a constraint .(Cronje,2006).Moreover teachers often are not prepared to carry out their new role of teaching with ICT tools. (Abdelrahman, 2009)

Although most schools in Sudan have computers and Internet connectivity, most principals, teachers and students do not know what to do with computers installed in their labs.(Abdelrahman, 2009).

.This research problem is: To what extent are the governmental colleges of education in Khartoum State ready to prepare competent teachers to integrate ICT in secondary schools.

1-3 Purpose of the Study:

The purpose of this study is to investigate the current status and the problems facing Sudanese collages and faculties of education. And their capability to graduate well trained teachers to use ICT in secondary education.

1-4 Research questions:

1- What ICT infrastructures (equipment, software, access to internet etc. are available in the Sudanese collages and faculties of education?

2- Are the syllabi appropriate and up to date?

3- Are the trainers ready to train the teachers?

4- What are the challenges and problems face Sudanese colleges and faculties of education to do so?

1-5 Significance of the research:

- It may help policy makers to construct a comprehensive program for teacher development in ICT in Sudan.
- It may help the Sudanese collages and faculties of education to evaluate and promote their ICT infrastructures, syllabi and teachers trainers.
- It may help the ministry of education to fulfill its national policy to integrate ICT in teaching and learning.-This research is significant because it is unique so it is a good addition to the Sudanese library.

Chapter 2
Literature Review and Previous Studies

2-1 Literature Review

2-1-1 new innovation and Educational Change:

As we leave the 20th century behind and head into the 21st, we will have experienced in this past 14 years the greatest social and scientific advances since the industrial revolution started in the 18th century. We have learned to communicate by means never even thought of or imagined before this century. The integration of technologies and systems have allowed for the creation of inventions that have carried us to the moon, brought the world's images into our homes by the flick of a switch, and allowed the deaf to hear; all due to the vision and the knowledge of people using technology to control the «human-made world» and improve their surroundings. People use current technologies in appliances and devices that they don't understand, but have come to trust in the system that created them.

Our students today are going to be tomorrow's scientists, researchers and technologists. Gel plastic batteries and solar cells may power the car they will drive that is controlled by a computer guidance system. Even today's cars are computer controlled and need specially trained technicians to operate the analyzers to trouble-shoot and adjust them.

Without an understanding of systems, computers, and the ability to relate to multiple systems, the technician of tomorrow will be lost. As our technological world becomes even more complex, these technicians will require interdisciplinary skills that will allow them to analyze, interpret and apply information to vastly different systems. Therefore, the school system of the future must address the need for these interdisciplinary skills by challenging the students and teaching critical thinking and problem solving skills in the curriculum structure today (Hall and Mark, 2004).

2-1-2 Using ICT in Education:

Existing research on education technology includes a small number of national studies that describe teachers' use of technology, as well as their training to use these tools. Most current and past uses of education technology have typically supported traditional notions of teaching and learning. For example, in the early 1980s, students most often used computers for drill and practice (Becker, 1983). Typically, drill-and-practice software consists of sequences of worksheet-style questions that automatically adjust their difficulty to match individual students' responses. Also, in the early 1980s, teachers typically used computers to teach students programming skills (Becker, 1983). They rarely used computers for content-related instruction (Becker, 1985); students were more likely to learn about how to use computers at school than they were to use computers to learn about mathematics or social studies (Becker, 1983).

By the early 1990s, the practice of using computers for programming had declined considerably and an emphasis on using computers as a tool for learning content had emerged (Becker, 1994; Sutton, 1991). However, the primary use of computers remained drill and practice in elementary schools in the early 1990s. In high schools, it was classes on computer education, and middle schools provided a combination of drill and practice and computer education (Becker, 1994). Finally, as the decade of the 1990s progressed, school computer use had shifted to some degree to reflect a greater emphasis on problem solving and in-depth learning and less emphasis on drill and practice and basic skills. Fulton, 1997) found that 25 percent of the 1996.

2-1-3 ICT Use in Schools and Classrooms:

In recent years, policymakers have recognized that teachers and administrators need resources and organizational capacity to implement instructional reforms (Coley, 1997; Trotter, 1999; U.S. Congress, Office of Technology Assessment, 1995a) . For example, teachers' ability and willingness to use computers and the Internet may depend, to some extent, on the schools and classrooms in which they work. Specifically, certain characteristics of classrooms and schools, such as equipment, time, technical assistance, and leadership, may act as either barriers to or facilitators of technology use.

2-1-3-1 Equipment:

On a most basic level, teachers may be more likely to integrate computers and the Internet into classroom instruction if they have access to adequate equipment and connections. Research indicates that the number of computers in America's classrooms and schools has grown substantially in recent years. In 1983, there was one computer for every 125 students (Glennan &Melmed, 1996). By 1998, there was one computer for every 6 students (Rowand, 1999). As thenumber of computers in schools has grown, so has the availability of the Internet in schools and classrooms. Between 1994 and 1998, Internet availability among public schools increased from 35 to 95 percent (Williams, 2000). In 1997, 27 percent of instructional rooms had Internet connections, whereas 63 percent were connected in 1999 (Williams, 2000). By 1999, there was one instructional computer with an Internet connection for every 9 students (Williams, 2000).

However, availability is not the same as use. Computers may be available, but are they being used? Research suggests that the answer is yes, to some degree. As availability has grown, so has the number of students and teachers using computers and the frequency with which they use them (Levin et al., 1998). For example, the percent of eleventh-grade students who had never used computers in school dropped substantially between 1984 and 1996 (from 55 to 16 percent) and

the frequency with which students used computers increased between 1984 and 1996 (Snyder and Wirt, 1998). By 1996, 72 percent of fourth-graders, 47 percent of eighth graders, and 50 percent of eleventh-graders reported using a computer in school at least once a week (Snyder and Wirt, 1998). Although the presence of computers and the Internet has grown sharply in recent years, much of the technology equipment currently in schools and classrooms is from an earlier generation of technology—computers with less processing power, less storage capability, and limited capacity for being linked together electronically (Anderson & Ronnkvist, 1999). Using data from 1998, Anderson and Ronnkvist, 1999) have concluded that although computing capacity for instruction has improved substantially over the past several years, there are a number of "major deficiencies" (p. 16). For example, they found that most of the computers in schools do not have the capability to run a large variety of multimedia software and are also limited in how they can access graphical information on the Internet.

2-1-3-2 Time:

The nation's schools have been increasingly challenged by policy initiatives "to do better, and to do differently" (McLaughlin & Oberman, 1996, p. iv), pushing teachers to change the way they teach. At the same time, teachers face many other challenges, including rapidly increasing technological changes and a greater diversity in the classroom. With regard to technology, there is often little time in teachers' schedules to become familiar with hardware and software or to learn to integrate the new technology into their lesson plans (President's Committee of Advisors on Science and Technology, 1997). Lack of time to become acquainted with technology and learn to use it has been identified as the greatest obstacle to the effective use of education technology (Becker, 1990b; President's Committee of Advisors on Science and Technology, 1997.

However, teachers' opinions are divided over time gains using ICT. On the one hand teachers complain about the lack of time to integrate ICT; on the other hand

studies show that there are considerable time savings in medium and long term planning which can be corporately shared in reducing teachers' workload as the ICT test bed study shows (Underwood, 2006). There seems to be a need to show teachers how ICT can save time, if efficiently used. "We need to shift the focus on process management to put into place new ways of working to maximize the value of ICT" (Underwood, 2006).

2-1-3-3 Technical Assistance:

Another important resource for the development of teacher expertise in the use of education technology is technical assistance. A full-time computer coordinator, for example, may assist teachers with using computer software and hardware or adapting their teaching practice to include computer or Internet use. However, according to one study, less than 5 percent of all schools have such a staff member. Furthermore, where they are present, computer coordinators typically spend a significant amount of time teaching students, and much less time assisting teachers (Becker, 1998).

2-1-3-4 Leadership:

Principal leadership has been described as one of the most important factors affecting the effective use of technology in classrooms (Byrom, 1998). Principals who exhibit leadership are instrumental in modeling the use of technology in classrooms. They understand how it can support best practices in instruction and assessment and provide teachers with guidance for its use. Principals may also participate actively in professional development activities related to education technology and provide teachers with opportunities to learn how to use these resources. In our nation's schools, however, teachers often receive little administrative and pedagogical guidance (President's Committee of Advisors on Science and Technology, 1997). For some teachers, lack of principal leadership may prove to be a barrier to their effective use of technology.

Although information and communication technology (ICT) is not a panacea for all educational problems, today's technologies are essential tools for teaching and learning (Capper (Ed.), 2011). To use these tools effectively and efficiently, teachers need visions of the technologies' potential, opportunities to apply them, training and just-in-time support, and time to experiment. Only then can teachers be informed and confident in their use of new technologies (Bowes, 2003).

2-1-4 Infrastructures:

Infrastructure questions and decisions are coupled with educational needs, opportunities, and outcomes. Therefore, to achieve optimum educational results, each educational institution should base infrastructure decisions on an assessment of a mix of technical factors and educational needs and objectives. The results of such an assessment then must be compared to the costs and benefits of a variety of computer system configurations and infrastructure options.

When carrying out an educational infrastructure assessment, the following points may need to be considered:

Educational goals:

What educational goals and learning objectives will be accomplished by using computers?

Professional development:

Will the computer system be used for teacher professional development and to supplement classroom teaching? Enhancing teacher professional development by training teachers both to use computer and Internet technologies and to integrate these technologies into education, along with improving subject matter competence and strengthening pedagogical skills, are often important objectives of school computer programs.

Student-to-computer ratio:

What target ratio of students per computer is the school or school system aiming for?

School's electrical system:

What is the state of the school's electrical system? What is the availability and quality of electrical power and the type and distribution of electrical wiring in the school? Computers operate better and last longer when the electricity that powers them is continuous and of consistent voltage.

Financial resources:

How much money is available to purchase and install the equipment, buy software, train teachers, and support, maintain, and use the equipment?

Is there a budget for ongoing maintenance, supplies, and technical support, and for replacing aging equipment and obtaining more computers?

School routine:

Do students move from class to class throughout the day, or spend most of their time in one room?

The answer affects decisions about using computer labs and/or placing computers in classrooms.

Internet connectivity:

Will the computers be connected to the Internet?

Connecting computers together

: Will the computers be installed as stand-alone systems or connected together to form a local area network (LAN?)

Temperature and air quality:

Will rooms with computers need to be air conditioned or protected from excessive dust?

Special-needs or disabled students:

Will special-needs students use the computer system? Is physical access to computers by students in wheel chairs an important issue?

Other physical conditions:

What are the sizes and shapes of classrooms? What is the quality of natural or electrical lighting? Are telephone lines distributed throughout the schools? What types of desks, chairs, benches, and tables are available?

2-1-5 Barriers for effective ICT use in educational institutions

Many studies and researches concern about the difficulties that affect the full use of ICT in education. The identification and understood of these difficulties will help policy makers, leaders and teachers to plan for their work and overcome these difficulties. The following analysis aims to present the perceived barriers to the use of ICT which were highlighted in the reviewed studies and examine their causes and effects. The barriers are broadly divided into three categories: teacher-level barriers, i.e. those related to teachers' attitudes and approach to ICT, educational institutions-level barriers, i.e. those related to the institutional context and system-level barriers, i.e. those related to the wider educational framework.

2-1-5-1Teacher level barriers

• Lack of ICT skills

The evaluation of the ITMF project in Denmark and the E-learning Nordic study revealed that in some cases the reasons for selecting a technology are affected more by the teacher's skills than by professional consideration: 'Many teachers still chose not to use ICT and media in teaching situations because of their **lack** of ICT skills rather than for pedagogical /didactics reason.

• Lack of motivation and confidence in using ICT

Their limited ICT knowledge, makes teachers **anxious about using ICT** in the classroom and thus do **not feel confident** to embrace new pedagogical practices. The 2004 Becta survey on the perceived barriers to the uptake of ICT by teachers also refers to the 'teachers' fear of admitting to their pupils their limited ICT knowledge.

• Inappropriate teacher training:

It is interesting to observe that although some teachers have good ICT skills in terms of their own personal use, they are unable to transfer these skills to using ICT in the classroom (Becta, 2004). Inappropriate teacher training programs fail to engage teachers in using ICT both during their lessons. The most commonly mentioned cause of this is that training courses focus mainly on the development of ICT skills and not on the pedagogical aspects of ICT. Traditional teacher training does not prepare teachers for facilitation and support roles that are required in student-centered learning. Furthermore, specific learning needs of teachers are not address by most of the training courses and they are rather **'**up-front' than regularly updated and followed-up sessions.

Thus, effective training is essential for teachers to implement ICT in an effective way in their teaching. On the other hand, when training is inappropriate, teachers are not sufficiently prepared, and not sufficiently confident, to make full use of technology in the classroom.

2-1-5-2 Educational institutes – level barriers

Some well trained teachers are still not able to make use of that training since they are hampered by a range of educational institutes' level factors. These are:

The absence and poor quality of ICT infrastructure.

The **absence of technology** is a crucial hindrance factor for the successful implementation of ICT The **lack of high quality hardware** and **suitable educational software** is considered by the majority of ICT coordinators as an important hindrance to further development of ICT in education in many studies. Poorly maintained computers are usually Unreliable and likely to cause disruption to even the best planned lessons.

Also, inappropriate software does not enhance a lesson in any way and rather disengages both teachers and students from the learning process. Therefore, the

amount, range and quality of ICT resources available to the teachers are an important influence on the use of ICT in subjects and classes.

Limited Access to ICT equipment:

The inability of teachers and students to access ICT resources is a result of a number of other factors and not only of the lack of ICT infrastructure. Sometimes a school may have high quality of ICT resources but these are inappropriately organized and thus not optimally used. In some schools for instance, ICT classroom is used only for the ICT lessons so the other teachers are not allowed to use it . As a result teachers and students do not have the opportunity to use ICT at any time according to their needs.

Schools' limited project-related experience:

Ramboll Management estimates that the main barrier for the ITMF projects has been that the framework for the implemented development projects has not been the best: if schools had participated in more projects, they could have been able to better respond to the requirements of national initiatives (such as ITMF).

Absence of ICT mainstreaming into schools' strategies:

Schools face the problem of unsuccessful organizational implementation of ICT because ICT is not seen as a part of the general strategy at school level. Even if some schools have developed ICT strategies, these are not integrated into the school's overall strategies.

2-1-5-3 System-level barriers

• The rigid structure of the traditional schooling system

Sometimes education systems work against ICT impact and even if educators are not ICT-resistant, in some cases the system under which they work is. For example, in UK, national tests are not made for ICT rich schools. Studies such as the Test Bed study give some valuable results concerning the factors that impede EUN has carried out the following survey on the availability of curriculum related digital learning resources (European School net, December 2006).

Yet, this is evident in some countries more than in others; in Finland for instance, where differences between schools are fewer and assessment is based more on evaluation, this is less the case.

2-1-6 Teacher Education:

2-1-6-1 Background:

Teacher education programs have struggled with selecting and implementing the most effective strategies on how to prepare pre-service
teachers to integrate technology in their future lessons (Goktas, Yıldırım, and Yıldırım, 2008). Many programs have attempted to develop pre-service teachers' technology skills through an introductory educational technology course (Polly, Mims, Shepherd, & Inan,2010). In one survey of 1439 institutions with teacher education program in the United States (Kleiner, Thomas, & Lewis, 2007), 85 percent of those programs reported having an educational technology course ranging from one to four credits. By taking an educational technology course, pre-service teachers are expected to transfer knowledge and skills to their future classrooms (Brush et al., 2003). However, as stated before, the evidence suggests that pre-service teachers do not feel prepared to effectively use technology in their classrooms (e.g., Drent & Meelissen, 2008; Kay, 2006). These studies may indicate the importance of pre-service teachers' understanding with regards to technology: pre-service teacher education should not only focus on how to use technology, but also how technology can be used for teaching and learning.

Many researchers have suggested that technology skills should be integrated throughout the teacher education curriculum in order to
Provide pre-service teachers with the skills and experiences needed to apply technology to their specific content areas (e.g., Niess, 2005).

These programs emphasized technology training in authentic teaching situations. In this respect, pre-service teacher education programs
provide a wide range of approaches throughout their curriculum (based on Ottenbreit-Leftwich et al., 2010; Polly et al., 2010): information delivery of technology integration content (e.g., lectures, podcasts), hands-on technology skill building activities (e.g., workshops),

practice with technology integration in the field (e.g., field experiences), and technology integration reflections (e.g., electronic
Portfolios). Recent studies have revealed that the best practices provided to pre-service teachers with regards to technology training include authentic experiences in real K-12 classrooms (e.g., Ottenbreit-Leftwich et al., 2010).

Based on the assumption that technology should be connected to specific content areas, Koehler and Mishra (2009) introduced the concept of Technological Pedagogical Content Knowledge (TPACK). TPACK encompasses an integrative knowledge base of technological
knowledge and skills, as well as knowledge of learners, subject matter content, and pedagogy necessary for teachers to be competent to teach with technology in the classroom (Koehler & Mishra, 2009). TPACK is a framework that emphasizes the importance of preparing pre-service teachers to make sensible choices in their uses of technology when teaching specific content to a specific target group. According to this framework, technology integration does not require one single pedagogical orientation; it includes a spectrum of approaches to teaching and learning. Teachers select specific technological applications in line with their selections of other curricular variables and processes (e.g., instructional strategies) that fit into their existing educational beliefs (Tondeur, Hermans, van Braak, & Valcke, 2008). In this respect, many researchers believe that technology skills should be integrated throughout the teacher education curriculum, thus providing Pre-service teachers with experience in applying technology to specific content areas and pedagogical approaches (Brush et al., 2003; Kay, 2006).

2-1-6-2 International Experiences of ICT Usage in Education:

2-1-6-2-1 The National ICT strategies in Finland 2010

There have been so far four official national strategies for the information society or national ICT strategies, and before these one national educational ICT

development project in Finland. The recommendations of the TOP Project (TOP, 1986; 1989) in the eighties can be seen as the first, although it was an unofficial or semi-official national ICT strategy.

Each University was supposed to formulate strategies of their own in harmony with the national strategies, and even though they have not necessarily been updated recently, they do have continuous obvious effects on the planning of curricula as well as TE programmes. An example of these strategies is the Information Technology Strategy

developed at UH (Strategy, 1996) right after the publication of the first official national strategy in 1995. The latest development in this field is that the teacher training schools attached to universities have co-operated nationally in formulating their own strategies (Strategy, 2009).

The Ministry of Education and Culture has financed teacher educators' in-service training courses or staff development projects supporting ICT use in TE from the mid 90s until the end of year 2007. These in-service courses and projects have aimed to develop teacher educators' ICT-competence and they have been designed based on the ICT strategies in each Finnish university. As an example of this type of staff development

project, one at UH is shortly described below (for more detail see Lavonen, Lattu, Juuti, & Meisalo, 2006).

A project at UH is an example of a university level ICT strategy development project for TE. An ICT strategy and an implementation plan for TE were created in a co-operative process during the two academic years 2000-2001 and 2001-2002 at the Faculty of Behavioural Sciences in UH. Visions and expectations of staff members and students were registered by questionnaires and by making notes during co-operative

sessions in which the strategy was created. Thereafter, an implementation document, where the staff development programmes and plans of how to develop

ICT infrastructure and to integrate ICT in TE, was created. A large program for staff ICT skills development was implemented and a new infrastructure (a new domain and websites etc.) was developed. Altogether 53 one or two credit point in-service courses were organized

on the use of basic ICT tools and learning management tools, web publishing, and ODL solutions. As many as 505 staff members participated in these ICT courses. On the basis of staff self-evaluation data we may evaluate that staff ICT skills developed substantially

and ICT use in TE grew more versatile.

On the basis of the data collected during the staff development project, a list of properties needed for a successful staff development project was created. The main facilitator for development of ICT skills was the co-operative local ICT strategy planning and implementation process where staff became aware of the possibilities of ICT use as a part of teaching and learning and how ICT use and ODL solutions can make teaching

and learning in TE more versatile. Secondly, the development of an ICT infrastructure especially web publishing and the use of ODL solutions, reduced the constraints usually associated with versatile ICT use. Thirdly, organizing multiform and versatile courses, which were co-operative, reflective and contextual, helped staff members to improve their ICT competence . The courses demonstrated how ICT and ODL solutions could be used in TE and staff members could easily try and evaluate different ICT uses. Consequently, there are some basic conditions that should be realized before staff members use ICT in TE: They should have an ability to control ICT use in teaching and learning, and ICT

use should maximize the effectiveness for achievement of higher level goals of TE and not interfere with achieving other higher order goals.

After the systematic staff development project described above, several ICT courses have been organized for staff members annually. These courses have been partly financed with the resources allocated by the MEC specifically for this purpose. It is not clear how these types of courses could be financed in future. Moreover, there have been available

ICT-courses offered by the Educational Centre for ICT at UH. These courses are generally offered to all staff members of the university without any special orientation to TE. The final comment on the effects of steering through strategies is that there seems to be too little co-ordination and harmony between different types of national and local

level strategies. When there are too many, too different, and too often changing strategies, their implementation in the formulation of goals or in teaching practice is very difficult. Perhaps the most important effects of different evaluation processes can be accredited to the self-evaluation phase. However, there have been so many and frequent efforts to implement new strategies and recommendations for various types of evaluations which have had little connection with these strategies that most members of staff are totally exhausted and reluctant to make further efforts. Furthermore, there have been indications that the adopted top-down approach to strategy implementation may be problematic

(Lavonen & al., 2006). In addition to implementation of the ICT strategies through seminars, training and tutorials organized for teacher educators, the academic curriculum is an important tool for strategy implementation focusing on the development of skills of student teachers. For example, at the Department of Teacher Education at UH, goals for learning the use of ICT in education are described in the aims of TE courses and teaching practice. In the primary school TE programme, there is an ICT driving license course and test that aims to introduce basic ICT tools and university ICT services, like databases and library

services. In addition, there is a media education course to introduce different types.

of ICT use in school education. More specific competences to use ICT, for example, in the analysis of research data are learned within courses designed for research methodology. Moreover, there are goals for ICT use in teaching and learning within the aims for teaching practice.

Student teachers in the subject teacher education programs learn to use basic ICT tools at their home departments. The goals for learning pedagogical use of ICT are described among the aims for specific pedagogical courses. For example, in the course "*Theoretical, psychological, and didactical basis related to teaching and learning particular subject*" these student teachers should learn to use versatile teaching methods and ICT in the teaching of their subject. During their teaching practice, student teachers should learn to use as a support the theories of education, pedagogy and learning while analyzing and developing their own pedagogical approaches for teaching the subjects. In the Finnish system of subject teacher education there are three partners who participate in the programs and make important contributions. The subject departments at various faculties have focused traditionally on educating future researchers (or artists) and little on the future needs of those students studying for teaching careers. However, this situation has been and is changing as the importance of TE is now quite generally recognized. This is at least partly due to the societal role of universities being at the forefront of discussions on the budgetary needs of universities and the major impact of teachers in forming the new generations, the future of the whole society (Lavonen, Krzywacki -Vainio, Aksela, Krokfors, Oikkonen, & Saarikko, 2007).

Some subject departments have had chairs with the responsibility to supervise TE at the department. The crucial role of subject departments is in ascertaining the high level of content area knowledge for subject teachers is highlighted by their writing their Masters' theses at the department of their major subject. The thesis

facilitates the future teacher's access to research-oriented work, and emphasises the understanding of the creation process of new scientific knowledge in their field of teaching and learning. What is most important is the goal of preparing future teachers to autonomously understand and utilize

new achievements in scientific research. One of the interests of subject departments is in recruiting new talented students. The departments therefore maintain contacts with schools and urge student teachers to meet with young people, even in their free time (e.g., at shopping malls) to introduce them to interesting science phenomena. The interaction with pupils not only at school but also in their leisure time also provides student teachers with valuable experience of working with young people. We may note an important role of subject departments had in the implementation of the very successful LUMA Project (LUMA, 2006) on advancing mathematics and science education in Finland in organizing Master - level courses for unqualified substitute teachers working at schools. In primary teacher education, at least in Helsinki, professors of subject area take responsibility for the quality control of specialization courses in their subject.

The second partner in TE is the Department of Teacher Education at the Faculty of Education (or equivalent). These institutions are responsible for organizing and developing the Master's level primary school TE program and the pedagogical studies of a subject TE program. In these institutions, there are professors of general education, educational psychology, etc., but also several specialized in educational problems of certain subject areas. It has been important that there has been a development towards full professor status for even the latter. Their focus has been on introducing students to research into teaching and learning and on how to implement research outcomes in teachers' daily work but also in further education including even international doctoral schools. Consequently, they have over the years played an important role in the development of research in these

areas. Pedagogical content knowledge has been one of the crucial issues in training of subject teachers, but the shift from *syllabus* type of thinking (emphasizing organization of contents) to *curriculum*-oriented ideas has put more importance on the goals of education at the student level and on the teaching-studying-learning process. Among other things, the pedagogical studies in TE introduce student teachers to the idea of *a teacher as a co-operative professional* who is able to develop him/herself while working as a formally competent academic teacher. This kind of professional is able to put forward arguments for the decisions that s/he makes regarding his/her own teaching.

2-1-6-2-2 Teacher Education in Switzerland 2013 (UNESCO)

ICT In Initial Teacher Education:

Teacher Training curricula for primary and secondary school teaching are defined at local level by the university or teaching training institution itself. These institutions are also responsible for the assessment of their students. Digital competences are considered to be a key competence for initial teacher education. Therefore, knowledge about ICT and how to use digital technology is integrated in the curriculum. As part of the general curricula, ICT related training is compulsory. The goal is that future teachers are competent using media and ICT in the classroom. It is expected that more guidance for teacher training in the field of ICT will be derived from the future national curriculum for compulsory schools (*Lehrplan21*). The *Lehrplan21* envisages "Media and ICT" not as a subject in its own right but rather as an inter- or transdisciplinary topic (*See 3.1 Curricular Framework*). There are 13 Universities of Teacher Education in Switzerland7, most of which have their own Centers for Media Education affiliated to them, which offer their services to the university as a whole. Depending on the individual university the centre may be a mere library for media, a consulting agency for the field of media education, or an independent department for research in the field. The Universities of Teacher Education in the

German speaking cantons of the country offer a total of 31 curricula for all school-subjects and all levels of teaching from pre-school to secondary II level.

ICT in in-service training in teacher education-CATION:

In-service training on all kinds of knowledge and skills related to the use of ICT in the classroom has already been compulsory for many years. In-service teacher training on ICT topics is the responsibility of the cantons and is offered by cantonal expert agencies for ICT. These are usually affiliated to the cantonal Teacher Training Institutions and work both with experienced in-service teachers and experts in the field of pedagogy and ICT.

New Initiatives:

The **MINT** learning **centre** at the Swiss Institute of Technology in Zürich (ETH Zürich) is to develop teaching methods, learning objects, programs and curricula for the teaching of Physics, Chemistry and Technology in schools at upper secondary level in order to improve students applied knowledge of these subjects. The primary target groups are Science Teachers from all European levels of school (from elementary to upper secondary) and vocational training institutions. At the MINT centre, in-service teachers develop new teaching materials while testing them in their schools. Feedback from the teaching at the schools feeds back into the learning centre's development teams.

The **Swiss Museum of Transport** in Lucerne initiated the **i-factory**, which provides an appealing, interactive way of testing basic techniques that underlie our information technology and an international encounter with its culture. At the visual centre of the i-factory, practical examples of the information technology that pervade our everyday lives, in particular the world of transportation, are shown with authentic pictures, film clips and computer animations. They build a bridge between the playful approach of the i-factory and the real world.

The **Museum of Communication** in Berne offers workshops, guided tours, as well as printed or digital guides for several topics relating to ICT.

Training of Teacher Trainers:

The training of teacher trainers is not coordinated at national level. There are two inter-cantonal initiatives in the field. The **teachers' association "MITIC"** offers ICT-courses for in-service teacher trainers as well as general help and guidance in the field in the French speaking cantons of Switzerland. **« PICTS - Pädagogischer ICT-Support »** is the corresponding body in German speaking cantons of the country. It offers a course on the theme of pedagogic ICT support, which caters for those In-service-teachers who are in charge of ICT issues, irrespective of subject or school type or level.

2-1-6-2-3 South Africa

(Guidelines for Teacher Training and Professional Development in ICT):

Approach to teacher development in ICT:

By incorporating certain essential principles, this document reflects a holistic approach to teacher development in ICT. It acknowledges that ICT skills cannot be practiced in isolation from their context. It also acknowledges that the development of ICT skills and knowledge for teachers should be an integral part of initial and continuing teacher development programs, as reflected in the National Policy Framework for Teacher Education and Development in South Africa.

The holistic approach to teacher development has the following three dimensions (adapted from the European Union's T3 Core Curriculum for Telematics in Teacher Training):

1- A pedagogical dimension, which implies an understanding and application of the opportunities of the use of ICT for teaching and learning in a local curriculum context.

2 -A technical dimension, which implies:

• An ability to select, use and support a range of ICT resources as appropriate to enhance personal and professional effectiveness; and

• The willingness to update skills and knowledge in the light of new developments.

3 -A collaboration and networking dimension, which includes

• a critical understanding of the added value of learning networks and collaboration within and between partners; and

• The ability to create and participate in communities of practice.

Principles for ICT in teacher development

The following are key principles to be followed in the professional development programs for teachers:

• Educational goals should be primary. The focus should not be on providing technical ICT skills only, but on the use of ICT to achieve learning outcomes.

• Teacher development programs should provide teachers with situated /contextualized learning experiences. Programs should be subject - specific and relevant to the learning areas.

• Teacher development programs should be needs driven. Programs should respond to the requirements of subjects such as Computer Application Technology, Information Technology, Geography, Design and Accounting.

• Ongoing support should be consistently available. This includes pedagogic support (particularly from subject advisers), technical support and creating communities of practice.

• Teacher development should be ongoing, due to the changing nature of ICT. Programs should reflect new technologies and applications.

Development levels:

The White Paper on e-Education outlines the following ICT development levels that are to be included in the framework:

• **Entry level.** The teacher is computer literate and is able to use computers. However, frustrations and insecurities are common in the introduction of ICT. At this level, teachers are likely to lack confidence.

• **Adoption level.** The teacher is able to use various ICT, including computers, to support traditional management, administration, teaching and learning, and is able to teach learners how to use ICT.

• **Adaptation level.** The teacher is able to use ICT to support everyday classroom activities at an appropriate NCS level, assess the learning that takes place and ensure progression.

He/she is able to reflect critically on how ICT changes the teaching and learning processes and to use ICT systems for management and administration. Productivity increases at this level.

• **Appropriation level.** The teacher has a holistic understanding of the ways in which ICT contributes to teaching and learning. He/she has an understanding of the developing nature of ICT, and awareness that it is integral to the structure and purposes of the NCS. He/she has the experience and confidence to reflect on how ICT can influence teaching and learning strategies, and to use new strategies.

• Innovation level.

The teacher is able to develop entirely new learning environments that use ICT as a flexible tool, so that learning becomes collaborative and interactive. ICT is integrated as a flexible tool for whole-school development through redefining classroom environments and creating learning experiences that leverage the power of technology.

2-1-6-2-4 Information technologies and education in the Arab World 2013

A new UNESCO report looks at how ICT is being used in education across five Arab states.

In spite of a push to incorporate ICT (information and communication technology) in education across the Arab world, several countries still lag behind, according to a new report from UNESCO.

The report is the first to focus on how ICT is being used in the region and focuses on five countries in the Middle East: Egypt, Jordan, Oman, the Occupied Palestinian Territories (data from the West Bank only) and Qatar. It identifies four main indicators of how ICT rates in education: infrastructure, gender, teacher preparedness and policy.

The basic infrastructure indicator looks at student access to technology and access to the Internet. Of the five countries, Egypt is a clear outlier. At primary school level, an average of 120 pupils share one computer, and at the secondary level, the number reduces to 25 students. The average number in the other four countries is between seven and 19 at the primary school level (Qatar and Palestine, respectively). These numbers drop to five students at the secondary school level.

The disparity between Egypt and the others becomes even more striking when looking at access to computers connected to the internet. Every 441 pupils at the primary school level share one such computer, dropping to 94 at the secondary school level.

Less than a third of the computers at schools in Egypt and the Occupied Palestinian Territories are connected to the internet, computers for educational and administrative purposes are both counted. In contrast, about two-thirds of computers in schools in Jordan, Oman and Qatar are online.

"Computers are not necessary as a pre-requisite for good thinking; good teachers are. But young learners need to use computers to be competitive in the global marketplace," says Marina Apaydin, professor of Strategic Management and Innovation at the American University of Beirut. "Not knowing ITC and language makes kids illiterate in the modern world and this is one of the reasons

MENA lags behind say China and India in producing competitive and mobile workforce."

When surveying teacher preparedness to use ICTs in classrooms, according to nationally-defined qualification standards, the report found that only "a minority of teachers are prepared to teach basic computer skills or computing" across the five states in both primary and secondary schools.

The report found that gender did not factor significantly in access to ICT in education. Interestingly, wherever such differences appear, they seem to favor access to and use of ICT by girls. These findings need, however, to be considered cautiously as the authors point out that the data speaks little about the methods of use of ICT by gender.

All five countries have formally developed policies to integrate ICT in education by establishing "regulatory institutions to ensure that ICT-assisted educational reform takes place." These policies do not translate, however into practice, the report says. Egypt and the Occupied Palestinian Territories also lag behind the three other countries when it comes to permeation of ICT curricula across all grades of primary and secondary education.

"The problem in Egypt is that a very ambitious modernization campaign was led to equip schools with computers and internet while less attention was given to building human capacities to use them, resulting in a lack of vision for sustainability of such initiatives," says Karim Kasim, telecasters regional coordinator for the Egypt ICT Trust Fun ¬—, which was jointly established by the Ministry of Communications and Information Technology (MCIT) and the United Nations Development Program (UNDP).

2-1-6-2-5 **Information and Communication Technology (ICT) In Education in Sub-Saharan Africa** (2015)

ICT in education policy and plans

Policymakers are in a unique position to bring about change. This is illustrated in a study of 174 ICT-supported innovative classrooms in 28 countries (Kozma, 2003). In 127 cases, there was an explicit connection between ICT innovation and national policies that promoted the use of ICT (Jones, 2003). But while the introduction of ICT policy is necessary for change, it is not sufficient to result in its implementation or impact (Tyack and Cuban, 1995). Policies can, of course, fail to succeed and this happens when: i) they are viewed as mere symbolic gestures; ii) teachers actively resist policy-based change that they view as imposed from the outside without their input or participation (Tyack and Cuban, 1995); iii) they do not have explicit connections to instructional practice (e.g. focus on hardware rather than their relationship to pedagogy); iv) they do not provide teachers with an opportunity to learn the policies and their instructional implications; and v) there is a lack of programme and resource alignment to the policies' intentions (Cohen and Hill, 2001).

As previously demonstrated in a UIS report on ICT in education in Asia (UNESCO-UIS, 2014), policies vary between countries by level of specificity. For example, ICT in education policy may be expressed within:

- References to ICT in education sector strategy policy documents and plans;
- References to the education sector in national cross-sector ICT policy documents and plans; or
- Specific ICT in education policy documents.

UIS survey show that in sub-Saharan Africa a number of countries have a policy addressing ICT in education. In some countries, for instance Djibouti and Togo, ICT in education policy uniquely covers certain education levels, most commonly upper secondary education. Only for upper secondary education Angola,

Botswana, Côte d'Ivoire, Eritrea, Gambia, Mauritius, Rwanda, Sao Tome and Principe, South Africa, Uganda and Zambia Ethiopia, Djibouti and Togo No information Benin, Burundi, Cabo Verde, Central African Republic, Chad, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Guinea-Bissau, Malawi, Mali, Namibia, Nigeria, Senegal, Sierra Leone, Somalia, Swaziland, United Republic of Tanzania and Zimbabwe Country has a policy on ICT in education No policy or plan Country has a national plan on ICT in education Botswana, Burkina Faso, Côte d'Ivoire, Gambia, Kenya, Liberia, Mozambique, Niger, Sao Tome and Principe, South Africa, Uganda and Zambia Cameroon, Comoros, Congo, Guinea, Lesotho and Madagascar .

While policies are defined as government-issued documents which set out the principles, guidelines and strategy for ICT in education, a plan is another important instrument. It documents how these principles are to be achieved within a specified timeframe and details each activity to be undertaken, the method employed for implementation, the timeframe, the resources required and the actors responsible for implementing each activity. Kenya's "National Information and Communication Technology (ICT) Strategy for Education and Training" (Kenya, 2006) is an example (http://nepadkenya.org/documents/MOE-ICT%20in%20Education.pdf). A number of countries across the region report having a plan to implement ICT into the education system.

In contrast, an active policy or plan does not exist in Cameroon, Comoros, Congo, Guinea, Lesotho and Madagascar.

ICT in education in national curricula

Despite variable capacity to provide ICT in education in all schools and for all children, UIS survey data show that, whereas most countries (responding to the survey) have established formal recommendations to integrate ICT in at least some subject areas, the level and grades recommended for integrating ICT in curricula vary. For example, in South Africa recommendations for integrating ICT begin in primary education and cover all subjects and grades, whereas in Côte d'Ivoire and Zambia formal recommendations exist for some grades in primary education and then all grades in secondary education. In contrast, formal - recommendations for integrating ICT in curricula are least common in Gambia, Madagascar and Sao Tome and Principe where they begin only at the upper secondary level and in just some grades. There are no formal recommendations at all for integrating ICT across subjects or education levels in Burkina Faso, Comoros, Guinea, Niger and Togo.

Moreover, formal recommendations are not always made for all subject areas. For example, Sao Tome and Principe has formal curricular recommendations for Social Sciences, whereas in Botswana formal recommendations exist to support Mathematics, Natural Sciences, Social Sciences and Foreign Language learning.

Computer Density:

Computers are more frequently available for secondary education (i.e. based on enrolment), which might reflect the tendency to prioritize ICT in secondary education curricula compared to primary education. In Gambia, the LCR decreases from 277:1 in primary education to 66:1 and 37:1 in lower and upper secondary education, respectively, while in South Africa, the LCR decreases from 90:1 in primary education to 54:1 for combined secondary. In other countries, evidence shows that LCRs remain very high in secondary education. For example, there are more than 500 learners on average sharing a computer in lower secondary education in Guinea, Madagascar and Niger, while at the upper

secondary level the LCR in Niger decreases to 94:1 but remains at over 500:1 in Guinea and Madagascar. Rwanda remains an exception to other countries in the region in that the ratio for both primary and secondary levels is the same at 40:1.

Computer-assisted instruction and deployment:

According to the survey, in sub-Saharan Africa CAI is generally offered in computer laboratories. For instance, laboratories have been established in all schools with CAI in Cameroon, Gambia and Madagascar and all secondary schools in Comoros, Lesotho, Niger and South Africa. In contrast, Sao Tome and Principe and Mauritius do not deploy CAI only in computer laboratories but presumably also in classrooms and other locations in the school. For example, out of 71% of secondary schools with CAI in Sao Tome and Principe, there are laboratories in just 47%. Similarly in Mauritius, while CAI is almost universal in schools, laboratories are found in 72% and 93% of primary and secondary schools, respectively. An exception to this pattern is Botswana, where out of 78% of primary schools offering CAI, just 10% have a computer laboratory.

Internet to support on-line learning:

Internet availability ranges substantially within sub-Saharan Africa. For example, Internet availability is negligible in schools in Burkina Faso, Guinea, Liberia and Madagascar. Generally, Internet is more available in secondary schools than primary schools, although remains scarce in 1% of combined secondary schools in Burkina Faso, 3% of upper secondary schools in Madagascar, and in 3% and 5% of lower and upper secondary schools in Guinea, respectively. In Niger the proportion of lower and upper secondary schools with Internet is 2% and 14%, respectively. Despite the progress achieved in decreasing the learner-to-computer ratios in Rwanda, Internet connectivity remains low with 6% and 18% of primary and secondary schools, respectively, being connected. At the other end of the range, Mauritius has connected 93% and 99% of primary and secondary schools, respectively, while Botswana has connected all public

secondary schools to the Internet. Data for private primary schools in Botswana are not available.

Looking forward: A call for action

ICT use in education is at a particularly embryonic stage in the majority of countries in sub-Saharan Africa. Nevertheless, there are new developments and announcements related to ICT in education on an almost daily basis somewhere on the continent. Yet, for many years Isaacs (2012) has noted that the focus of investment has been on making successive waves of new technologies work in resource-poor education environments – an emphasis that tended toward a techno-centric approach to ICT in education. Clearly, a strategy that prioritizes sound pedagogy, training teachers to use ICT effectively to support instruction and building overall capacity is more appropriate.

While ICT is being introduced in education in most countries – albeit at different paces – expansion remains slow due to a lack of effective policies, basic infrastructure (e.g. electricity, devices, Internet), financial resources and teacher capacity. As such, the introduction of ICT in education in a minority of schools has the potential of widening the digital divide based on several factors, including sex, location and socio-economic status.

2-1-7 ICT Competency Standards for Teachers:

The goal of the UNESCO ICT Competency Standards for Teachers (ICT-CST) project1 is to improve teachers' practice in all areas of their work. By combining ICT skills with emergent views in pedagogy, curriculum, and school organization, the Standards are designed for the professional development of teachers who will use ICT skills and resources to improve their teaching, collaborate with colleagues, and perhaps ultimately become innovation leaders in their institutions. The overall objective of the project is not only to improve teacher practice but to do it in a way that contributes to a higher quality education system which can, in turn, produce a better informed citizenry and higher quality

workforce that, as a result, advances a country's economic and social development.

More specifically, the objectives of the UNESCO ICT Competency Standards for Teachers project are:

• To constitute a common set of guidelines that professional development providers can use to identify, develop or evaluate learning materials or teacher training programs in the use of ICT in teaching and learning.

• To provide a basic set of qualifications that allows teachers to integrate ICT into their teaching and learning, to advance student learning, and to improve other professional duties.

• To extend teachers' professional development so as to advance their skills in pedagogy, collaboration, leadership and innovative school development using ICT.

• To harmonize different views and vocabulary regarding the uses of ICT in teacher education.

The goal of this paper is to provide professional development partners with information needed to consider their participation in the UNESCO ICT-CST project and to revise or prepare their curriculum and course offering proposals. The paper presents the overall structure of the Standards by:

• Identifying three complementary approaches that a policymaker can take to connect education reform and teacher professional development with a county's economic and social development policies.

• Listing six components of the ICT-CST framework.

• Describing the contents and specifying the levels of the modules that correspond to the six components of each approach.

• Detailing the objectives and suggested methods that a professional development provider may use to design learning materials that would support the goals of the UNESCO ICT-CST project.

The paper also identifies and discusses issues that providers should consider as they develop or revise their materials. Subsequent materials will detail the mechanism by which professional development

providers can submit their curriculum and learning materials for participation in the UNESCO ICT-CST program.

ICT COMPETENCY STANDARDS FOR TEACHERS

Three Approaches

The intent of the UNESCO ICT-CST project is to connect education reform to economic growth and social development that can improve the quality of education, reduce poverty and inequity, advance the standards of living, and prepare a country's citizens for the challenges of the 21st century. The Standards are based on three approaches to education reform that correspond to alternative, somewhat overlapping approaches to improve a country's workforce and fostering economic growth:

• Increasing the technological uptake of the workforce by incorporating technology skills in the curriculum—or the technology literacy approach.

• Increasing the ability of the workforce to use knowledge to add value to economic output by applying it to solve complex, real-world problems—or the knowledge **deepening approach.**

• Increasing the ability of the workforce to innovate and produce new knowledge and of citizens to benefit from this new knowledge—or the knowledge creation approach.

Taken as a set, these alternative approaches provide a developmental trajectory by which education reform supports increasingly sophisticated ways of developing a country's economy and society: from technology uptake, to a high performance workforce, to a knowledge economy and information society. Moving across the approaches, a country's students and ultimately its workforce

and citizenry acquire increasingly sophisticated skills needed to support economic growth and an improved standard of living.

Six Components:

The UNESCO ICT Competency Standards for Teachers also address six components of the educational system. It is important to note that the Standards do not merely focus on ICT skills. Rather, they include

training on ICT skills as part of a comprehensive approach to education reform that includes: policy, curriculum and assessment, pedagogy, the use of technology, school organization and administration, and teacher professional development.

Crossing these six components with the three approaches to form a matrix forms the UNESCO ICTCST framework. The detailed rationale for this structure is presented in a companion document.

Each of the cells of the matrix constitutes a module in the framework, illustrated below. Within each of these modules, there are specific curricular goals and teacher skills. Attached to this document are descriptions of the modules and teacher competencies, as well as detailed objectives and suggested methods for achieving these objectives within a professional development program.

The intent is that providers will use the framework, the detailed objectives and methods, and the guidelines in this document to develop new learning materials or revise current materials so as to support one or more of the three approaches.

The UNESCO ICT Competency Standards for Teachers especially the first approach (Technology Literacy Approach) is going to be the theoretical framework of this study. The researcher is going to investigate how well colleges and faculties of education in Sudan are ready to prepare pre-service teacher by ICT in education courses to integrate ICT in teaching and learning.

2-1-8 ICT Technology Advancement in Sudan:

2-1-8-1 SURVEY OF ICT AND EDUCATION IN AFRICA: Sudan Country Report (2007)

The Education System

In 1991, a new education philosophy was introduced to provide a frame of reference for the reforms. Education was to be based on the permanence of human nature, religious values, and physical nature.

The educational ladder was changed in Sudan in 1991 from 6-3-3 to 2-8-3 to include twoyears of pre-school, eight years of basic, and three years of secondary school. Following a political decree by the Higher Authority of Arabization, Arabic was made the official language of teaching and scientific curriculum at the governmental higher education institutions.

ICT Policies:

National policy:

In June 1999, the Sudanese national ICT strategy was formulated and a high-level ministerial committee was formed to oversee its implementation. The strategy focuses on five major areas: technology (infrastructure), human resource development, software industry development, content (Arabic reservoir), and geo-information.

Based on the knowledge and recognition of the importance of public-private partnerships in enhancing any development process, the Sudanese government is constantly seeking partners to implement the national strategy, including e-government projects, the development of an electronic smart city, distance learning, and telemedicine.

The General Ministry of Education Information Centre is the entity responsible for the development of a strong ICT infrastructure. The national policy encourages the use of ICT in developing local policies to ensure the complete integration of ICT in education and training on all levels, including the development of school curricula, teacher training,

managing and organizing educational institutions, and supporting the idea of lifelong learning by designing ICT training programs to satisfy the educational needs of employees working in the field.

Education Sector Policy:

The ICT policy for education was launched in 2002. The Information Directorate and Curriculum Centre and Training Directorate are the entities managing the implementation. In 2004, ICT was introduced in secondary education curricula. A number of computers were installed in schools (around 50% of secondary schools), at an average of 10 computers per school. In schools the connectivity is mainly through dial-up and ADSL. However, in higher education systems, it is through ADSL only. The country is planning to have computers available in all education levels by the year 2015 as agreed to at the ICT summit in Geneva.

The ICT curriculum has been introduced at Grade 4. The teachers have been trained on the basics of ICT. Both the government and the private sector provide access to the Internet as a learning resource.

Infrastructure:

In the last two decades Sudan built and capitalized on ICT, and the government has opened up competitive investments in telecommunication. Licensing was granted for newcomers employing advanced technologies, which are hoped to increase the spread of

and access to ICT and make products affordable.

Development in ICT in Sudan is evident in a substantial expansion of infrastructure and capital investment including management systems and human capital.

Radio stations:

Following are three examples of radio use in Sudan:

• *Civic Education via Radio for Southern Sudan:* In partnership with the National Democratic Institute (NDI), Education Development Center Sudan Radio Service

has developed a new civic education radio series that will increase listeners' knowledge of political developments and also promote increased discussion of political developments, tolerance of diverse viewpoints, and non-violent solutions to complex problems.

• *Sudan Radio Service:* As part of an effort to increase the participation of the southern Sudanese, the Sudan Radio Service provides access to balanced and useful information through radio-based education and entertainment programs presented by local presenters in several local languages.

• *dot-EDU Southern Sudan Interactive Radio Instruction (SSIRI) Program:* This program designs, develops, and pilot-tests appropriate and cost-effective technologies such as interactive radio instruction in an effort to provide learning opportunities for children, adults, and teachers in southern Sudan.

2-1-8-2 Implementing ICT in Education: What Helps and What Hinders?

The table below provides a summary of the (2007) stage of ICT development in Sudan in terms of enabling or constraining features in the education system (Hamdy 2007):

Factors	Enabling Features	Constraining Features
Policy framework and implementation plan	The national ICT policy was formulated mid-1999 and followed in 2002 with a national ICT policy on education, targeting mainly infrastructure, access, developing content, and human resource development	Outreach to rural and remote areas still poses a considerable Challenge. Poverty, lack of resources, and political unrest puts ICT lower on the priority list of basic needs in most areas
Advocacy leadership	A high ministerial committee was formed to oversee the prompt implementation of the national ICT policy, as well as the supervision of the Information Directorate and Curriculum and Training Directorate for the implementationof the education	Political unrest and civil war hinder nationwide implementation

	ICT policy.	
Collaborating mechanism	The Sudanese government has budgeted future revenues for infrastructure refurbishments and a multi-donor trust fund (MDTF) was created to support development projects. The UNDP is also supporting the government heavily through its ICT institutions to collectively share the interventions that promote ICT for human development	
Human resources	One of the major areas of concern of the national ICT policy formulated in 1999 is human resource development.	Skilled, trained staff who are well acquainted with the ICT tools are very limited. They also tend to prefer the private sector to government positions
Support	The government encourages investment and is paving the road for public-private partnerships as a means of offering more venues and creating better opportunities for the implementation of the ICT vision. Sudan is increasingly attracting attention from international investors interested in the oil revenues. These have attracted investment from Kuwait and UAE, and open the door for encouraging more investment	Financing and donor interest in Sudan remains limited, especially with the number of embargos that were imposed
Rural/urban divide	The efforts of the government remain focused on outreach to all parts of the country	There is a huge digital divide between rural and urban areas, especially in relation to computer literacy, and access to telecommunication infrastructure countrywide remain alarmingly low.
Learning	Provision of content is among	Arabic electronic content greatly

material	the five founding pillars of the national ICT policy. The government is focused on building a strong reservoir of Arabic content reflecting the culture and tradition of the region, and being accessible to a wide population	lags behind. Educational material and curriculum need total restructuring and rebuilding. Traditional and longstanding material and curriculum are still in use, which do not comply or meet with the needs of modern society.
Gender equality	A number of informal education projects target women as an underserved sector of the society. Women's participation and inclusion is also slowly increasing on the government level.	Female participation in public life in general and education and in the workforce in particular remain fairly low due to longstanding cultural factors and traditions.
Sustainability	The peace treaty signed in 2005 sets the grounds for more stable implementation of projects in different domains. A number of international development agencies, NGOs, and civil society organizations are dedicated to the development process with particular emphasis on education	The political instability in Sudan is a great hurdle that impedes the development process.

2-1-8-3 Ministry of Higher Education (Sudan):

IT Centre:

The Ministry of higher education and scientific research began at the end of 2003 to implement the project of virtual library in the Sudanese universities which aimed to connect thirty universities in all over Sudan, providing these universities with appropriate informatics services. This project was implemented by the Ministry of higher education and scientific research and was run by experts through consultant committee. All the stages of the project were financed by informatics support fund. In 2004 the ministerial decree number 51 was issued by the Minister of HE to form committee to unify and coordinate the efforts of establishing electronic library for the Sudanese universities.

In 2005 the decree number 9 was issued , from the national council of HE' in its 15th session, held in the university of Bakht Alruda (Aldoim) , this decree stipulated for establishing directorate for the electronic network and library in the Ministry and providing capabilities in higher education institutions to utilize its services. In may 2006, on the basis of a recommendation from the information network committee of higher education, the directorate of ITC was named, then the directorate began its work.

In May 2009 the administrative decree from the Ministry of labor was issued to promote all the directorates of information technology in federal ministries to general directorates under the general secretaries and undersecretaries, named the IT centers, because they are the organs assigned to implement the electronic government projects in the relevant ministries in coordination with the National Information Centre.

The Directorate's general objective:

Set up complete systems for information, make use of information technology in developing work, provide electronic services and respond to the country's plans in informatics industry in Sudan.

Vision:

Higher Education's community contents with electronic services rendered by the Ministry.

Mission:

Utilize information technology to facilitate access to information for the beneficiaries through their suitable channels competently and transparently.

Functions and Responsibilities:

- Lay down general policies of the information in the unit; prepare its plans and projects in the field of information.
- Supervise programs and projects of the information.
- Supervise the affiliated directorates of information.

- Build internal network, MAN and WAN for the unit, its departments and branches.
- Design the unit and its branches' website in the internet.
- Oversee the digital and non digital libraries, document information and archive.
- Lay down the bases of information exchange and its flow between the directorates, the unit, and other bodies locally and internationally. Disseminate this information by all means.
- Design and develop manual and computerized systems. Supervise the operations of analysis, organization, saving, process and retrieve.
- Update the information channel to coordinate with modern technological development.
- Supervise the development of human resources and capacity building in the aspect of information in coordination with the competent authorities.
- Lay down the policy and plans of security and protection and supervise their implementation.
- Represent the unit internally and abroad.
- Any other duties assigned to it.

Electronic services rendered by the directorate.

- SMS system
- Number of employees in the directorate: (6)

2-1-8-4 The Ministry of Education:

The ministry of education introduced computers in schools 2003and stated that the aims are to use computers in teaching, learning and for administrative purposes. In an official report, the ministry declared that 1200 computers distributed over 120 schools. In 2004 the number increased to 7800 computers. 570 computers distributed in Khartoum state in addition to 300 printers (Abdurrahman, 2009). But computers didn't use as a tool in teaching and learning except in some private schools.(Abdarahman,2009).

The ministry introduced ICT as a subject in secondary schools so as to be compulsory in 1st and 2nd years and optional in 3rd year (Abdurrahman, 2009).
Thus the ministry concentrated on technical aspect away from educational purposes. companies to help teachers in acquiring the basic skills to teach ICT as a subject and not as a tool in teaching and learning other subjects. Also, the ministry tried to provide PCs for teachers (Abdelrahman, 2009).

Teachers Training:

Teachers training a basic factor to implement a good educational policy. In Sudan the teachers are chosen qualified and helped to get stability and promotion opportunities in their career. However, the unprecedented development in basic and secondary education especially the increase of the duration of the basic level to eight years in 1991, led to the decrease in the numbers of well-trained teachers. The radical change in the school curriculum and the introduction of English Language to basic education starting from the fifth grade and computer science to secondary education in 2001, contributed to this decrease as it required the training and re-training of great numbers of teachers to ensure high standards of teaching (The EFA2000 assessment,2000).

Pre-service training:

The Ministry of Higher Education is responsible for pre-service training of all general education teachers. The implementation of basic and secondary education teacher training is conducted in the faculties of education where the students obtain the bachelor's degree or are prepared for the higher education studies. Teachers are now trained at colleges to be qualified academically and professionally. There are two types of teachers training colleges /programs: (Abdelrahman, 2009).

1- Colleges/ programs for basic education teachers: Basic education teachers are train in these colleges that are affiliated to the faculties of education of the universities (e.g. Khartoum and Sinar Universities).

2- Colleges to train secondary school teachers: Secondary-school teachers are trained in colleges for secondary school teachers or at the faculties of education of education of the universities and they awarded BED degree or a diploma in Education.

In-service training:

In 1996, there were 58 in-service training institutes spread throughout the country. They are technically supervised by the Federal Ministry of Education. Training in these centers are compulsory. Many principals and supervisors received in-service training. There are short training courses for newly appointed teachers. English Language supervisors and computer subject teachers are trained to work in multilingual areas. Also special education teachers have special course in producing instructional materials and audiovisual aids.(Abdelrahman 2009)

It is to be noted that the former teachers training institutes have been transformed into faculties of education associated with universities, in their respective areas, granting their graduates bachelor's degree in education (for the basic education level)

Promoting ICT in Education in Sudan:

According to the ICT4Africa report (2006), a number of organizations, particularly the UNDP and UNESCO, are intervening to assist the government of Sudan through its ICT institutions to promote ICT in education. This process will assist formulating a national strategy involving all stakeholders within the UN ICTD program framework. There is a great need for other providers of resourcing in Sudan. The most important programs /initiatives are:

1- Master degree in Computer Integrated Education:

The Sudanese Ministry of Education and Ministry of Technology had been planning the introduction of computers into schools in Sudan, but teachers training is a constraint. It was decided to develop capacity in this region by offering bursaries to promising Bachelor of education graduates for master

program in Computer Integrated Education. Upon completing the program they would train teachers to use ICT in schools in Sudan (Cronje, 2006). The project is a collaborative initiative between Sudan University of Science Technology and the University of Pretoria. Partner/Donor: UNESCO Institute for International Capacity Building in Africa(IICBA).Two groups graduated from this program 2003 and 2010.

2-1-8-5 **UNESCO »Communication and Information Sudan*:***

Currently there are four OA digital repositories in Sudan which are registered in Open DOAR. The Sudanese Association of Libraries and Information Library English Literature Collection (SALI) is a Greenstone-based repository providing access to the conference outputs of the institution. Items are available in English and Arabic. The interface is also available in English and Arabic. The Sudan Open Archive (SOA) is designed and implemented by the Kenya and UK-based Rift Valley Institute, working with institutional partners in the north and south of Sudan. The Archive was created by DL- Digital Library Consulting using open-source Greenstone archive software developed by the New Zealand Digital Library project at the University of Waikato offering free digital access to knowledge about all regions of Sudan. SOA 3.0, includes two new special collections: the first thirty-two volumes of Sudan Notes and Records, Sudan's flagship scholarly journal, and the collected papers of the late Sudanese scholar, Richard Gray. It is maintained with support from the J.M. Kaplan Fund. Other partners include UNICEF, UNEP and the Southern Sudan Centre for Census, Statistics and Evaluation. Other OA repositories in Sudan include DSpace at Sudan University of Science and Technology (SUST), Khartoum Space (University of Khartoum Digital Repository) and Neelain- DSpace from Al Neelain University.

There are currently no OA mandates registered in ROARMAP.

Enabling Environment:

The University of Khartoum (U of K) will be having an Institutional Repository so researchers affiliated with its Faculty of Science will be able to comply with these Open Access policies by simply depositing a copy of their research papers at DSpace@ScienceUofK, either directly (via self-archiving) or with help from the repository managers (mediated deposit).

According to ITU (International Telecommunication Union) with a population of 45,047,502, Internet users grew from 30,000 in 2000 to 4,200,000 in 2011, it implies that 9.3 percent of the population has an internet access.

Potential Barriers

Poor ICT infrastructure and Low level of awareness of the potentials of Open Access amongst organizations that sponsor research activities in Sudan.

Major Projects/Initiatives:

EIFL has been working in Sudan since 2003. EIFL engaged with the **Sudanese Research and Education Network SudREN** (previously SUIN), and through this partnership, libraries in Sudan are providing access to a wide range of scholarly e-resources. In **2014, Sudanese Universities Library Consortium (SULC)** has been established.

In **2011-2013 EIFL** provided financial support to 34 projects that implemented national and institutional open access (OA) advocacy campaigns to reach out to research communities and OA publishing initiatives. Through small grants and support from their own institutions, the projects engaged in a wide variety of campaigns and activities, including: holding workshops, creating websites, building institutional OA repositories, creating e-learning courses, and implementing OA publishing platforms. A new 2012 EIFL project planned to extend Dspace(at)ScienceUofK to become the University of Khartoum's OA institutional repository (IR) and conduct awareness-raising campaigns among students and researchers across three significant institutions in Sudan: **the**

University of Khartoum, the leading higher education and research institution in Sudan that produce over a half of the Sudanese research output; **Sudan University of Science and Technology (SUST)**, the first and leading polytechnic university in the country; and **El Neel in University** whose enrollment includes a large number of distance learning students.

Key achievements:

- Successfully engaged undergraduate students and young researchers to become new, major stakeholders in the project. The students created a SudHENL Facebook page and also provided feedback for innovative ways to raise awareness of OA among students, including drama and poetry based OA promotion activities.
- Government officials from the Sudanese Ministry of Communication and the Ministry of Justice, as well as journalists were also introduced to the benefits of OA. The Ministry of Justice is currently discussing strategies for a simple, standardized way to grant copyright permissions to all Sudanese output available online (Creative Commons licenses was one of the approaches being discussed).
- The University of Khartoum's Faculty of Science IR expanded to become a University of Khartoum OA IR. A productive dialogue was established at University of Khartoum during a one-day training course of 17 librarians and University administrators with regards to depositing materials in the OA IR.
- University of Khartoum created a Digital Content Online Higher Committee and one of its responsibilities includes drafting an OA policy. Three meetings have already taken place and OA policy wording is in progress.
- SUST and EL Neelain universities set up OA repositories (using DSpace FOSS) with the help of an enthusiastic IT engineer at University of Khartoum who installed and customized DSpace for them and trained IT engineers at SUST and El Neelain. Librarians at the three universities were trained by Rania M. H. Baleela on depositing into a DSpace repository. Both events took place under a

UNESCO fund that was obtained by the Sudanese Universities Information Network (SUIN) – the national research and education network in Sudan composed of 37 governmental and private universities and institutions – prior to the start of SudHENL.

OASCIR is a 10-month project aiming to promote awareness of Open Access-related issues among the U of K researchers, scholarly community, librarians and beyond. It is funded by EIFL.net.. This project started on March 2011 and two training courses on Open Access and the IR management were scheduled for the end of July- funding of the Project and of this specific training activity respectively by EIFL-OA and the Carlos III University Madrid. See also OASCIR Project blog

The Open University of Sudan (OUS) is a partner with The Open University (UKOU) in the project Teacher Education in Sub-Saharan Africa Project (TESSA). It brings together teachers and teacher educators from across Africa. It offers a range of materials (Open Educational Resources) in four languages to support school based teacher education and training.

National and Institutional Level Policies/Mandates

Many current funding agencies operating in Sudan have established some kind of Open Access policy, by which the research results of such funding (that is mainly research papers) should be made available Open Access within 6 or 12 months from its publication on a research journal.

Details of Key Organizations:

Open University of Sudan (OUS), In pursuit of the desire to liberate higher education from the limitations of time and place, the Sudanese Council of Ministers founded the Open University of Sudan *(*OUS) in 2002. OUS is a partner with The Open University (UKOU) in the project Teacher Education in Sub-Saharan Africa Project (TESSA).

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Sudan Libraries & Information Association :

Communication address: University of Khartoum - Sudan Library, 6865 People's Assembly, Khartoum, Sudan; e-mail: saliforum(at)yahoo.com

Past and Future OA Related Activities

Open Access Anthropology in Africa is a multilingual anthropology portal with news blogs in English, German and Norwegian posted an introduction to Open Access Anthropology in Africa highlighting the anthropology related papers in Sudan Open Archive

A Workshop on Digital Libraries was held during 14 –18 December 2002 in Khartoum, Sudan, by Sudan British Council in collaboration with Documentation and Information Centre of National Centre for Research and Sudatel Training Centre, entitled ”The Impact of Ncr-Dic Readiness In Realizing Sudan Digital Library” By Rafaa Ashmallah Ghobrial.

Free publishing and access opportunities with the Oxford Journals, Oxford Open initiative on 14 Jul 2009, it includes full and optional open access across more than 70 journals in every subject area. For each of the Oxford Journals that offers an open access model listed here authors in the developing countries.

Open Access awareness-raising campaign among researchers at the Faculty of Science, University of Khartoum (UofK) implemented by the Faculty of Science, University of Khartoum Library with the partner: GrandIR, CB, a Carlos III University Madrid and launched this blog.

In April 2011, Sudan was amongst the five winner projects presented in Africa in the EIFL call for proposals: Open access advocacy campaigns. EIFL provided financial support to 11 projects - national and institutional open access advocacy

campaigns to reach out to research communities: five projects in Africa (Botswana, Ghana, Malawi, Sudan and Zimbabwe)

Report from the OASCIR Training Week (Jul 24-30th). Along the week from Jul 24th to 30th, a series of training courses and dissemination activities on Open Access and the DSpace@ScienceUofK pilot Institutional Repository (IR) were held at the University of Khartoum (UofK) in the framework of the eIFL.net-funded OASCIR Project (Open Access Scientific Institutional Repository).

2-2 Previous Studies:

2-2-1 Amal Ahmed Study (1998) titled: The Educational aspects of Introducing Computers in Sudan Universities. This study aims to clarify the positive aspects of introducing computers in education in the educational institutions in Sudan. In addition to ensure the importance of introducing computers beside the teacher who plays effective role in the classroom.

The study was descriptive and the researcher uses the questionnaire, interviews and observations to collect data. The target group was the universities inside Khartoum state.

The outcomes of this study stated that introducing computers in the educational institutions in Sudan is an urgent need. And the existence of computers in the class room is not going to cancel the role of the teacher.

2-2-2 Alexander, 2005)

(Aninvestigationintoimplementationofcomputer -Assisted Education in the underprivileged areas of the Eastern Cape:

A case study of Butterworth High school) The study aims to know what has done after using computers in teaching the syllabus at Butterworth High Schools. The study was descriptive and the researcher used interviews. Checklist and document analysis to collect data . The target group was 7 students, the headmaster, computer technician, ICT teacher and a supervisor from the ministry of education.

The researcher found that, the student from class7 to class12 can use the internet to study. There is special computer lab for teachers training.

They depend on educational software as part of electronic education.

There is a computer lab to train student on Microsoft Office.

2-2-3 Sadegül Akbaba-Altun (2006)

Complexity of Integrating Computer Technologies into Education in Turkey

The aim of this study was to identify the issues related to integrating computer technologies into a centralized education system. Data were collected from seventeen school principals, fifteen computer coordinators, and one hundred and fifty one elementary education supervisors. The sources of data included semi-structured interviews and a survey. By using content analysis, the following ICT implementation issues were identified: infrastructure, personnel, curriculum, administration, and supervision. By improving these areas, IT classrooms will be more effective.

The findings of this study suggest that there are too few computers, slow Internet connections, insufficient software in the native language, and a lack of peripheral equipment at schools. ICT investment is important initial step as mentioned in the literature.

The IT classrooms at schools were placed in existing older classrooms that were not designed according to the needs of IT classrooms at schools. Future schools should be designed with adequate wiring, ergonomics and security in IT classrooms.

Another finding of this study indicates that in-service training courses for teachers are insufficient, especially in content areas. The participants indicate that courses are given by unqualified trainers and are not geared towards preparing them according to their needs and levels. These in-service training courses also have a lack of hand son activities and are not offered for school principals and

teachers. The findings of this study indicate that supervisors do not consider themselves as competent enough to be able to supervise IT classrooms. There needs to be a priori training and support before supervisors are sent to schools. Moreover, more empirical research and case studies are needed to better understand how supervisors can provide effective supervision

Curriculum problems generally stem from the available software programs at schools. According to the findings in this study, these software programs were not considered to be suitable for the students' grade levels by the participants. One of the reasons may be that a needs analysis was not conducted prior to sending these materials to schools..

School principals' lack of technical knowledge, their interpretations of regulations according to his/her own will, and their lack of support pave a way for the given problems and issues.

2-2-4 Marjolein Drent *, Martina Meelissen.(2006). Which factors obstruct or stimulate teacher educators to use ICT innovatively?

This paper discusses the factors which stimulate or limit the innovative use of ICT by teacher educators in the Netherlands.

Innovative use of ICT is defined as the use of ICT applications that support the educational objectives based on the needs of the current knowledge society. Explorative path analysis and case studies were used to study the potential influencing factors.

Results show that several factors on teacher level influence the implementation of innovative ICT use in education. Especially, teachers who are so-called 'personal entrepreneurs' are important for the integration of ICT in teacher education. School level factors turn out to be of limited importance for innovative use of ICT. This indicates a limited involvement of the management of teacher training institutes towards the use of ICT within the curriculum

Also, the research paper found that, Based on the assumption

that education in the knowledge society will be more student-oriented in the learning process, it was expected that the relationship between the pedagogical approach of the teacher educator and the innovative
use of ICT would be stronger.

The results of the case studies indicate that teacher educators who use ICT innovatively, develop their competence based on the educational goals they want to accomplish with the help of ICT. Their active attitude and the ICT goals they set for themselves, play an important role in this.

The factor personal entrepreneurship influences the innovative use of ICT in different ways (see Fig. 2).

First, there is a direct effect of personal entrepreneurship on the innovative use of ICT. Second, personal entrepreneurship
indirectly influences the innovative use of ICT through four different chains:

1. Personal entrepreneurship! ICT attitude! Innovative use of ICT
2. Personal entrepreneurship! ICT attitude! Perceived change Pedagogical approach! Innovative use of ICT
3. Personal entrepreneurship! ICT attitude! Perceived change! ICT competence! Pedagogical approach! Innovative use of ICT
4. Personal entrepreneurship! ICT competence! Pedagogical approach! Innovative use of ICT

2-2-5 Gilbert Study, 2007) titled: The Implementation of computers in Schools in South Africa. A case study of five schools in the Makana and Somerset East District). It was a descriptive study. The researcher uses the checklist, interviews and document analysis. The target group was some headmasters, teachers technicians and some educational supervisors from the ministry of education.

The aim of this study is to know the strategies used by policy makers in South Africa for implementing computers in schools.

The outcomes of this study stated that some schools is not going to get benefits of implementing computers in education for the following factors:

-The lack of support in repairing computers.

-Teachers computer skills is poor

-Lack of recourses and equipment that necessary tor using computers in education.

The schools that got benefits provide:

-Ready computer labs and other supportive equipments

- Arrangement for continuous maintenance operations and teachers training

2-2-6 Abdurrahman Mohammad Ahmad,(2009) study titled (The Application of Communication Technology and Information Strategies in Sudan Schools)

The aims of this study were:

-To ensure that the infrastructures of communication technology and information is existing in Sudanese secondary schools.

-To ensure that teachers are trained and other facilities are ready.

-To ensure to which extend that communication and information technology control the educational system.

-To ensure that the educational objectives are obtained in secondary schools.

The outcomes of this study stated that Sudan is poor in the basic infrastructures of communication and information technology and Sudan is located at the bottom of the list comparing with the other countries in applying communication and information technology. Also Sudan secondary schools need direct orders from the ministry of education to apply communication and information technology in teaching and learning. Also, the outcomes recorded some positive signs despite of the traditional insight towards the application of communication and information technology in education in Sudan.

It was a surveying study. The researcher uses the questionnaire, interviews and document analysis. The target group was 1st and 2nd year secondary schools in addition to some headmasters, teachers and technicians.

2-2-7 Ann-Britt Enochsson and Caroline Rizza (2009)

This research review reports on articles presenting empirical research in the area of how teacher training institutions work on preparing future teachers for the integration of information and communication technologies (ICT) in their future classrooms. It was conducted mainly in English and French and covers research in 11 OECD-countries during the years 2002–2009.

According to the presented research, the following is needed:

- Policy level: Define clear expectations, carry out evaluations and give room for enough flexibility for the changing field.
- Management level: Offer career possibilities, relevant incentives and suitable equipment, define clear expectations on cooperating schools and mentor teachers in addition to what is already mentioned for a policy level.
- Local actors level (teacher trainers, mentor teachers and student teachers): Ensure basic technological skills, integrate technology as a natural part in subject courses as well as internship, and learn about pupils'technological worlds.

2-2-8 Izzelden Ibrahim Mohammed Ibrahim (2009) titled Sudanese Secondary Schools Teachers Readiness towards E-learning. The main question of this study is: What are the various factors contributing in E-learning readiness in schools that make some Sudanese secondary teachers show an early involvement in e-learning innovation, while other show late response or resistance to this new technology?

This study found that there were many problems existing in the Sudanese secondary schools significantly deterred the teachers' readiness to ICT some of these problems are:

1- Absence of strategic implementation in computer training in secondary schools.

2- Lack of adequate information on ICT and its effective role in increasing secondary school teachers' efficiency.

3- Misuse and mismanagement of computers in secondary schools.

4- Lack of teachers trained on how to integrate e-learning in to their curriculum.

Presence of large numbers of pupils in classroom, lack of equipments, suitable and relevant infrastructure, specialized and effective educational program and high cost of computers hardware and their related maintenance.

2-2-9 Umkalthoum Mohammed Khar Mohammed (2011) the study titled: Using Educational Technology in Student Teachers Education program within Sudanese Colleges of Education and The Students Attitude Towards it. The researcher recommended the following:

1- The establishment of educational technology section within the college of education which must award bachelor of education in the specialization.

2- Insuring maximum utilization of the recent innovation in the field of educational technology within the educational program.

3- Introducing new curriculum of ICT and methods of applying new technology.

4- Paying interest for computerized educational program based on multimedia.

5- The establishment of new units to design technological programs that shall be used for educational purposes.

6- To acknowledge in abroad and accurate way the methods of electronic education.

2-2-10 Charles Buabeng (2012)

Factors influencing teachers' adoption and integration of information and communication technology into teaching

5- This article reviews personal, institutional and technological factors that encourage teachers' use of computer technology in teaching and learning

processes. Also teacher-level, school-level and system-level factors that prevent teachers from ICT use are reviewed. The researcher concluded that these barriers include lack of teacher ICT skills; lack of teacher confidence; lack of pedagogical teacher training; lack of suitable educational software; limited access to ICT; rigid structure of traditional education systems; restrictive curricula etc

2-2-11 Mohammed Hassan Ismaeil Taha (2013) titled: Trends in Electronic Learning and teaching in Engineering Education. The main question of this study is: What trends are emerging in online engineering on education in developing counties?

The study found that:

1- Online methods in engineering education increase the breadth and scale of engineering education In South Africa.

2- The quality of engineering education can be dramatically improved through collaboration among institutions.

3- Materials for engineering education can be utilized across institutions thus, increasing quality and driving down costs.

4- Engineering education offered in blended format is likely to become much more prevalent in the upcoming years.

5- Engineering students and lecturers are becoming more used to the benefit of the teaching and learning online blended format.

6- New trends and technology will emerge in online methods in emergency education.

2-2-12 Cynthia Dzimiri and Letwin Mapute,(2013), Integration of Information Communication Technology (ICT) with pedagogy. Great Zimbabwe University. Zimbabwe

The paper seeks to clarify the importance of integrating ICT in the learning and teaching processes. This includes the use of smart phones in schools where learners can research and send each other educational messages. Also importance

of using computers in schools is highlighted and this promotes competence among school learners and with the outside world. The paper also looks at teacher competence in terms of using ICT. Advantages and limitations of using ICT in schools are discussed at the end of the paper before conclusion

The paper found that the effectiveness of integrating ICT with pedagogies depends on high levels of interactivity amongst and between students and teachers, and between students and the technologies they use. In teaching for conceptual development teachers use ICT to empower students to purposefully select activities, applications and modes of communication. They also gather and make electronic resources available to students for anytime access. So the effective use of education technology requires teachers to have both the skills and a certain comfort level to make full use of what technology has to offer.

It reveals that computer plays a crucial role. Computers are readily adapted to provide selected types of information same time and relieve programs of considerations effort in data processing. However the usefulness of a computer depends on what program designers apply to its capabilities in the form of intelligence and creativity. Generally computers are important tool in the management of information system. Therefore the limitations of computers should be considered in developing or expanding their use in the management and information system.

2-2-13 Huda Hashim Obaied Ahmed (2014) Implementation of Virtual Laboratories in Training Practical General Chemistry, An experimental study at (SUST).

The study found that the use of the virtual lab gave the student the opportunity to interact with modern technology discovering its pros and cons. It assisted the students to become skilful in conducting laboratory experiment thus, creating a positive attitude towards virtual lab. However no significant difference was observed between the performances of the students using traditional or virtual

lab. Also, the study found that the virtual lab gave the students the feeling of confidence when conducting the real experiment, And it led to conserving the time and they could repeat the experiment without worrying of consuming chemicals or damaging equipments. Over and above it created a cooperative educational structure.

2-2-14 Mukhtar Uthman Sideeg (2014)

The utilization of the World Wide Web by university staff in scientific research and their attitude towards it

The research aims at perceiving the utilization of teaching staff members in the Sudanese universities to the internet as a scientific research tool the sample is formed of teaching staffof The University of Khartoum and AL-Zaeim Alazhari University the researcher used the descriptive method , questionnaire and interview as the main tool and used the SPSS program to analyze the data.

Findings:

- There are positive trend by teaching staff of Sudanese universities towards the utilization of W.W.W.(internet) in scientific research.
- There are no statistical significant differences in the percentage of internet usage in scientific research.
- The most significance hindrances of the members utilization are represented in the increase of financial burdens consequences of internet participation the difficulties of university correlation with internet.
- The teaching staff member succeeded in accessing most sites that provide data after paying the participation fees.
- The most important proposals to achieve and develop the usage of the internet are represented in studying English Language terms and provide internet centers in Sudanese universities.

2-2-15 Mubarak Abakar Jibreel (2015)

The Attitudes of the university staff towards the Integration of Multimedia in the Faculties of Education in Khartoum State.

The study tried to find out the real availability of multimedia in education in the universities in the state of Khartoum and the obstacles face its use and to identify the attitude of the faculties members towards it.

The researcher used the descriptive analytical method and used the questionnaire, interview and observation to collect data and used SPSS to analyze data.

Findings:

- High accessibility of some media in some universities.
- Some members lack familiarity to use multi-media.
- There is a positive opinion of the use of multi-media in teaching by faculty members because it saves time and efforts .
- There are reasons of hindering the use of multi-media in teaching involving teaching staff on one hand and university administration on the other hand for its provision of assistive devices and the creation of devices.
- The lack of computers in many universities.

The researcher comments on the previous Studies:

The main topics of the previous studies discuss the factors which stimulate or limit the innovative use of ICT by teacher educators, the utilization of the World Wide Web by university staff in scientific research and their attitude towards it, Using Educational Technology in Student Teachers Education program within Sudanese Colleges of Education and The Students Attitude Towards it, the importance of integrating ICT in the learning and teaching processes, Implementation of Virtual Laboratories in Training Practical General Chemistry, Factors influencing teachers' adoption and integration of information and communication technology into teaching and how teacher training institutions

work on preparing future teachers for the integration of information and communication technologies (ICT) in their future classrooms.

This study,(The Readiness of the Colleges of education (Sudanese governmental faculties and colleges of education in Khartoum state) to prepare well trained teachers to use ICT in secondary schools) covered different area. The main question is: To what extend are the faculties and colleges ready to (the infrastructures, syllabuses, and trainers) to prepare those teachers. And this makes it unique and a good addition to the existing literature and beneficial to the policy makers, institutes and teachers.

Chapter 3

Research Design and Methods

3-1 Introduction:

Although the Sudanese Ministry of education has launched the ICT policy for education in 2002, there were no data regarding teachers' education or teachers' training especially pre- service training. This Study aims to investigate current status of pre-service teachers training in the governmental colleges of education in Khartoum State – Sudan- to implement ICT in secondary education.

3-2 Research Design:

The researcher used descriptive approach because this study is surveying and descriptive. It is descriptive because it intends to describe the current situation to find out some results which will lead to beneficial recommendations and suggestion in this area. (The descriptive analysis approach is one of the common methods because researchers can collect reliable information and facts as far as possible about a group, phenomena, or an area (educational, social) Agil,1982). Gay and Airasian (2003) looked to a survey research as a descriptive study to determine and describe the way things are. Also, Maree (2007, p.48) pointed to it" survey data can be used to describe the status of things, show change and make comparisons" (Abdelrahman (2009).

3-3 Research Procedures :

This chapter outlines the research methods used in this study in terms of population and sampling, instruments, data collection, research procedures, data analysis and validity and reliability.

3-4 **Population:**

According to McMillan 2001,p169), "a population is a group of elements or cases, whether individual, objects, or events that conform to specific criteria and to which we intended to generalize the results of the research" The population features in this study was drawn from governmental colleges of educations in Khartoum State where the teachers are suppose to be prepared to integrate ICT in secondary education.

.3-5 The Sample:

"The sample is a sub-group of the population and it consists of many items or members and usually the study relay on them "Cohen, Manion and Morison, 2002). The sample of this study is taken from the students, trainers, technicians and management of the governmental colleges of education in Khartoum state. The researcher used Stratified Sample because it gives a very high precision, i.e. low sampling error, because of the good representation of the population characteristics in the sample.

First, the researcher used (Probability Proportional to Size) PPS to select three colleges of education randomly from six colleges which are :(arranged according to establishment date)

- Khartoum University (A)
- Omdurman Islamic University (B)
- Sudan University (C)
- Alnelan University (D)
- Azzaeem University (E)
- Bahri University (F).

Table (1) PPS (Probability Proportional to Size

Universities (1)	No. of Students(2)	Cumulative (3)
A	520	520
B	600	1120
C	487	1607
D	370	1977
E	375	2352
F	175	2527
Total	2527	

The interval k= 1042

- Look to the Random number, it is (348).

- Then College. (A) is the first to be selected in the sample Then(F) and(F). Adding the interval to the random number.

Then the researcher followed these steps:

• The population is sub-divided into Strata. Each Stratum (college of education) is homogeneous internally.

• A sub-sample is drawn from **Each** Stratum (students)

• The totality of the sub-samples constitutes the stratified sample size. The sub-sample was drawn using: Systematic RS.

• The size of the sub-sample from each stratum was determined through Equal Allocation Which means that the sub-sample is equal for All strata irrespective of the size of the stratum, because all strata have approximately the same size.

• $n_1 = n_2 = \ldots\ldots = n_{h\ldots..}$

• Where: n_h = sub-sample from stratum (h).

n = total sample size.

Table (2) the frequency distribution of students with respect to university:

Univers.	Frequency	Percent	Valid Percent	Cumulative Percent
U of K	46	40.7	40.7	40.7
SUST	49	43.4	43.4	84.1
Bahri	18	15.9	15.9	100.0
Total	113	100.0	100.0	

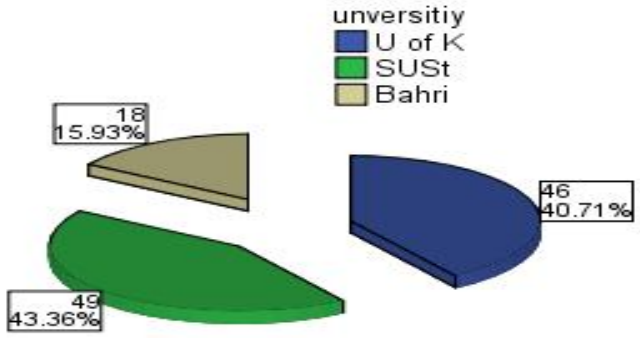


Figure 1 the frequency distribution of students with respect to university

Table (3) The frequency distribution of trainers with respect to university:

	Frequency	Percent	Valid Percent	Cumulative Percent
U of K	4	33.3	33.3	33.3
SUST	4	33.3	33.3	66.7
Bahri	4	33.3	33.3	100.0
Total	12	100.0	100.0	

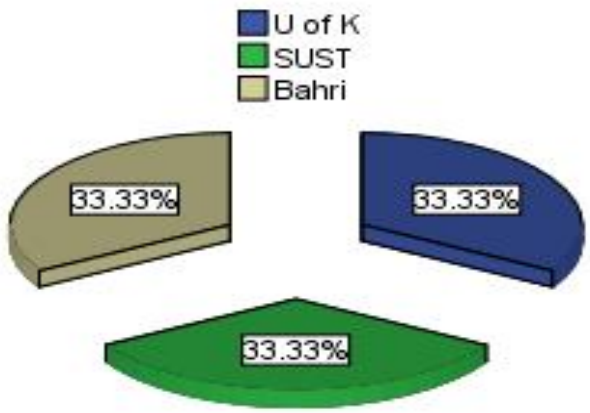


Figure 2 frequency distribution of trainers with respect to universit

3-6 Data Collecting Tools:

The researcher used questionnaire and observation to collect data. :

3-6-1 Questionnaire:

The researcher chooses to use questionnaire with trainers and students because it allows the collection of both subjective and objective data through the use of open or closed format questions. The trainer's questionnaire consists of 20 closed questions. And the student's questionnaire consists of ten closed questions.

3-6-2Observation:

Observation is used because it is useful to gather information about particular physical behavior. Also it provides an opportunity to collect information directly about what is actually occurring with the natural setting. It yielded very objective information. The researcher used it with the infrastructure.

3-6-3 Interview:

The researcher used interview with the administrator and technicians to collect subjective information.

3-7 Perspective:

The research perspective was evaluated by the students, trainers and an administrator. Because, evaluating of students and the concept of teachers are very important in this study. The researcher employed both quantitative analysis

using questionnaire and survey data and qualitative analysis from observations and content analysis.

According to Hysamen (1997)-relaying on Abdurrahman essay (2009)-description of quantitative research typically discern a cycle of successive phases of hypothesis formulation, data collection, analysis and interpretation. Using a deductive approach, and test hypotheses that have already been tested.

3-8 Research Matrix: Table (4)

Instrument Questions	Interview	Observation	Questionnaires
What ICT infrastructures (equipment, software, access to internet etc. are available in the Sudanese collages and faculties of education?	✓	✓	✓
- Are the syllabi appropriate and up to date?		✓	✓
-Are the trainers ready to train the student teachers?		✓	✓
What are the challenges and problems face Sudanese colleges and faculties of education to do so?	✓	✓	✓

3-9 Validity and reliability:

Validity refers the extent to which the questions or procedures actually measure what they claim to measure." Validity refer to the accuracy or trustfulness of

measurement" (David,1994,p.48) in this research the two questionnaire were presented to a number of experts in the field of education, CAA and English language e.g. Dr. Izzadin Abdallah, Dr. Mudawi Almusharaf , Tawfeeg Khaleel , for their comments on the content, form and language accuracy.

Reliability refers to consistency or dependability of the data. "Reliability refers to the consistency of measurement the extent to which the result are similar over different forms of the same instrument or occasions of data collections" (McMillan &Schumacher,200,p239) The researcher used the same tools again to some students from the sample, and they obtained almost the same results.

Table(5) Reliability Statistics :(Students teacher questionnaire)

Cronbach's Alpha	N of Items
75.4%	29

Table (6) Reliability Statistics: (Teachers' trainers' questionnaire)

Cronbach's Alpha	N of Items
90.7%	42

3-9 Statistical Analysis:

To achieve the objectives of the study and to verify the hypotheses, the use of statistical methods the following:

1. Graphic formats.
2. Frequency distribution of the answers.
3. The percentages.
4. Stability test (Reliability Test) for phrases using the questionnaire (Cronbach's Alpha coefficient).

For accurate results as possible, it has been using Statistical Package SPSS (Statistical Package for Social Sciences).

The researcher used SPSS to analyze the data.

The researcher used:

Frequencies, percentage, chi squire, Likelihood Ratio, DF and sig

CHAPTER 4

Data Presentation, Analysis and Discussions

4-1 Introduction:

In this chapter the researcher is going to show and discuss the results of the students 'questionnaire, the trainers' questionnaire, the observations and the interviews which held with the head of educational technology departments.

4-2 Students teacher questionnaire:

Table (7) the frequency distribution of students with respect to university:

Univers.	Frequency	Percent	Valid Percent	Cumulative Percent
U of K	46	40.7	40.7	40.7
SUST	49	43.4	43.4	84.1
Bahri	18	15.9	15.9	100.0
Total	113	100.0	100.0	

Table (7) above shows that (40.7%) sample unit were from (University of Khartoum) since (43.4) were from (Sudan University of Science and T technology), (15.9%) of them from (University of Bahri).

Table (8) the frequency distribution of students' Computer experience with respect to universities:

University	Computer experience							
	Poor		Good		Very good		Excellent	
	Count	N %	Count	N %	Count	N %	Count	N %
U of K	3	6.7%	24	53.3%	14	31.1%	4	8.9%
SUST	4	8.2%	27	55.1%	12	24.5%	6	12.2%
Bahri	3	16.7%	11	61.1%	3	16.7%	1	5.6%

Chi-Square Tests

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.407	6	.756
Likelihood Ratio	3.283	6	.773

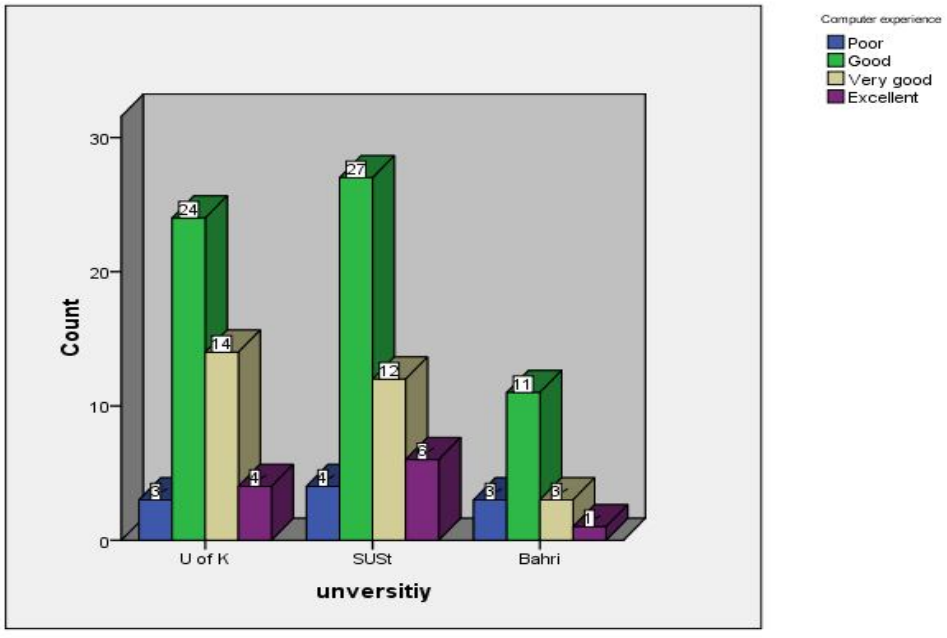


Figure 3 **the frequency distribution of students' Computer experience with respect to universities**:

Table (8) and figure (3) above show that (6.7%) of the students of university of Khartoum have poor experience in computer, most of them (53.3%) have good experience, (31.1%) of them have very good experience and (8.9%) have excellent experience. When (8.2%) of the students of Sudan University of Science and Technology have poor experience in computer, most of them (55.1%) have good experience, (24.5%) of them have very good experience and (12.2%) have excellent experience, while (16.7%) of the students of the University of Bahri have poor experience in computer, most of them (61.1%) have good experience, (16.7%) of them have very good experience and (5.6%) have excellent experience . So there is no statistically significant differences between universities (Sig = 0.756 , 0.773) >> (0.05) that they have good experience.

Table (9) the frequency distribution of students with respect to presence of PC at home:

Questions		University					
		U of K		SUST		Bahri	
		Count	Column N %	Count	Column N %	Count	Column N %
Do you have a PC at home	Yes	22	53.7%	27	56.2%	9	50.0%
	NO	19	46.3%	21	43.8%	9	50.0%

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.214	2	.899
Likelihood Ratio	.214	2	.899

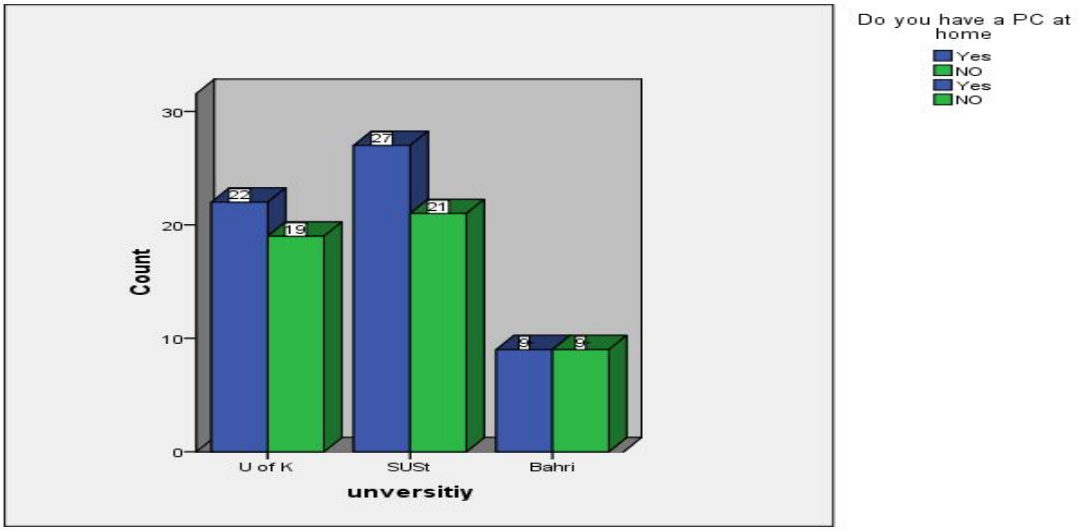


Figure 4 **the frequency distribution of students with respect to presence of PC at home**:

Table (9) and figure(4) above shows that (53.7%) of the students of the University of Khartoum own PC at home, (46.3%) do not, (56.2%) of the students of Sudan University of Science and Technology own PC at home, (43.8%) do not, while (50.0%) of students of university of Bahri own PC at home, 50.0%) of them do not, with no statistically significant differences between universities (Sig = 0.756 , 0.773) >> (0.05) .

Table (10) the student teacher's attitudes towards ICT:

Questions		University						**Pearson Chi-Square Tests**	
		U of K		SUST		Bahri			
		Count	N %	Count	N %	Count	N %		
I love ICT	Disagree	0	.0%	0	.0%	0	.0%	Chi-square	.827
	Neutral	7	15.2%	5	10.2%	3	17.6%	df	2
	Agree	39	84.8%	44	89.8%	14	82.4%	Sig.	.661
Using ICT in education is an urgent need	Disagree	2	4.3%	4	8.3%	1	5.6%	Chi-square	2.029
	Neutral	5	10.9%	9	18.8%	3	16.7%	df	4

	Agree	39	84.8%	35	72.9%	14	77.8%	Sig.	.731
I prefer teaching without ICT	Disagree	27	58.7%	21	43.8%	8	44.4%	Chi-square	3.856
	Neutral	14	30.4%	15	31.2%	6	33.3%	df	4
	Agree	5	10.9%	12	25.0%	4	22.2%	Sig.	.426
I need more training to use ICT in teaching	Disagree	6	13.3%	5	10.2%	1	5.6%	Chi-square	2.744
	Neutral	7	15.6%	13	26.5%	3	16.7%	df	4
	Agree	32	71.1%	31	63.3%	14	77.8%	Sig.	.602

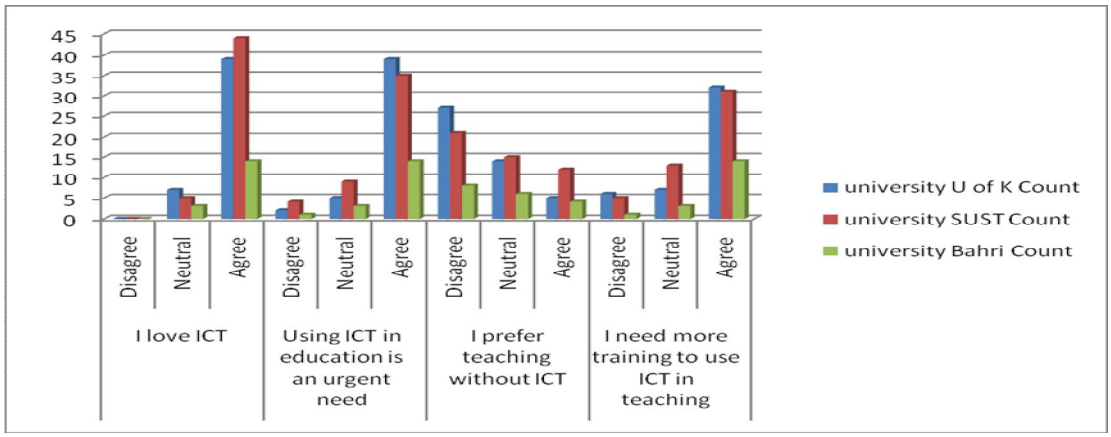


Figure 5 the student teacher's attitudes towards ICT

Table (10) and figure (5) above show that (84.8% , 89.8% and 82.4%) of the students of the University of Khartoum, Sudan University of Science and Technology and University of Bahri respectively, match love the ICT, (84.8% , 72.9%and77.8%) of them were agree that using ICT in education is an urgent need, (58.7% , 43.8%and 44.4%) of them prefer teaching with ICT and (71.1% , 63.3%and 77.8%) of them needs more training to use ICT in teaching.

Obviously that the students of all universities love the ICT, agree that its usage in education is an urgent need and they prefer teaching with ICT, but still need more training, with no statistically significant differences between universities (Sig = .661 , .731 , .426 and .602) >> (0.05) in students' attitudes towards ITC.

Table (11) distribution of student's skills level and confidence - the syllabi-Technology:

Components		University						Pearson Chi-Square Tests	
		U of K		SUST		Bahri			
		Count	N %	Count	N %	Count	N %		
Windows or other O.S	cannot use	7	15.2%	1	2.0%	1	5.6%	Chi-square	10.733
	Low	4	8.7%	3	6.1%	4	22.2%	df	6
	Moderate	23	50.0%	26	53.1%	9	50.0%	Sig.	.097
	High	12	26.1%	19	38.8%	4	22.2%		
File handling	cannot use	4	9.1%	2	4.1%	1	5.6%	Chi-square	3.162
	Low	4	9.1%	7	14.3%	2	11.1%	df	6
	Moderate	22	50.0%	19	38.8%	7	38.9%	Sig.	.788
	High	14	31.8%	21	42.9%	8	44.4%		
Data bases	cannot use	7	15.6%	5	10.2%	2	11.1%	Chi-square	7.174
	Low	10	22.2%	11	22.4%	8	44.4%	df	6
	Moderate	23	51.1%	22	44.9%	7	38.9%	Sig.	.305
	High	5	11.1%	11	22.4%	1	5.6%		
Spread sheets	cannot use	5	12.5%	11	23.9%	3	17.6%	Chi-square	4.612
	Low	9	22.5%	10	21.7%	6	35.3%	df	6
	Moderate	12	30.0%	15	32.6%	5	29.4%	Sig.	.594
	High	14	35.0%	10	21.7%	3	17.6%		
Word processing	cannot use	6	14.3%	3	6.7%	4	23.5%	Chi-square	5.841
	Low	6	14.3%	9	20.0%	2	11.8%	df	6
	Moderate	17	40.5%	14	31.1%	7	41.2%	Sig.	.441
	High	13	31.0%	19	42.2%	4	23.5%		
Presentation Software	cannot use	2	4.8%	6	12.8%	3	16.7%	Chi-square	4.231

	Low	10	23.8%	6	12.8%	3	16.7%	df	6
	Moderate	17	40.5%	21	44.7%	8	44.4%	Sig.	.645
	High	13	31.0%	14	29.8%	4	22.2%		
Web search engines	cannot use	3	6.7%	3	6.2%	0	.0%	Chi-square	3.752
	Low	3	6.7%	4	8.3%	0	.0%	df	6
	Moderate	18	40.0%	15	31.2%	8	47.1%	Sig.	.710
	High	21	46.7%	26	54.2%	9	52.9%		
E-mail	cannot use	5	11.6%	4	8.7%	1	5.6%	Chi-square	5.519
	Low	6	14.0%	3	6.5%	1	5.6%	df	6
	Moderate	14	32.6%	15	32.6%	10	55.6%	Sig.	.479
	High	18	41.9%	24	52.2%	6	33.3%		
Other	cannot use	9	30.0%	2	6.7%	2	15.4%	Chi-square	9.924
	Low	4	13.3%	9	30.0%	2	15.4%	df	6
	Moderate	15	50.0%	13	43.3%	8	61.5%	Sig.	.128
	High	2	6.7%	6	20.0%	1	7.7%		
Use of technology for communication and/or networking	not confident	1	2.2%	0	.0%	0	.0%	Chi-square	12.525
	Somewhat confident	10	22.2%	2	4.2%	3	16.7%	df	6
	Confident	10	22.2%	21	43.8%	9	50.0%	Sig.	.051
	Very confident	24	53.3%	25	52.1%	6	33.3%		
Use of technology for your own development and learning	not confident	1	2.2%	1	2.2%	0	.0%	Chi-square	1.684
	Somewhat confident	15	32.6%	12	26.1%	7	38.9%	df	6
	Confident	19	41.3%	19	41.3%	7	38.9%	Sig.	.946
	Very confident	11	23.9%	14	30.4%	4	22.2%		
Use of technology as management tool	not confident	11	25.6%	5	10.9%	4	23.5%	Chi-square	6.699
	Somewhat confident	21	48.8%	20	43.5%	7	41.2%	df	6
	Confident	8	18.6%	13	28.3%	5	29.4%	Sig.	.350

	Very confident	3	7.0%	8	17.4%	1	5.9%		
Use of technology for your future integration of technology	not confident	5	11.1%	4	8.5%	1	5.6%	Chi-square	2.092
	Somewhat confident	19	42.2%	15	31.9%	8	44.4%	df	6
	Confident	12	26.7%	16	34.0%	5	27.8%	Sig.	.911
	Very confident	9	20.0%	12	25.5%	4	22.2%		

Figure (6) distribution of student's skills level and confidence - the syllabi- :

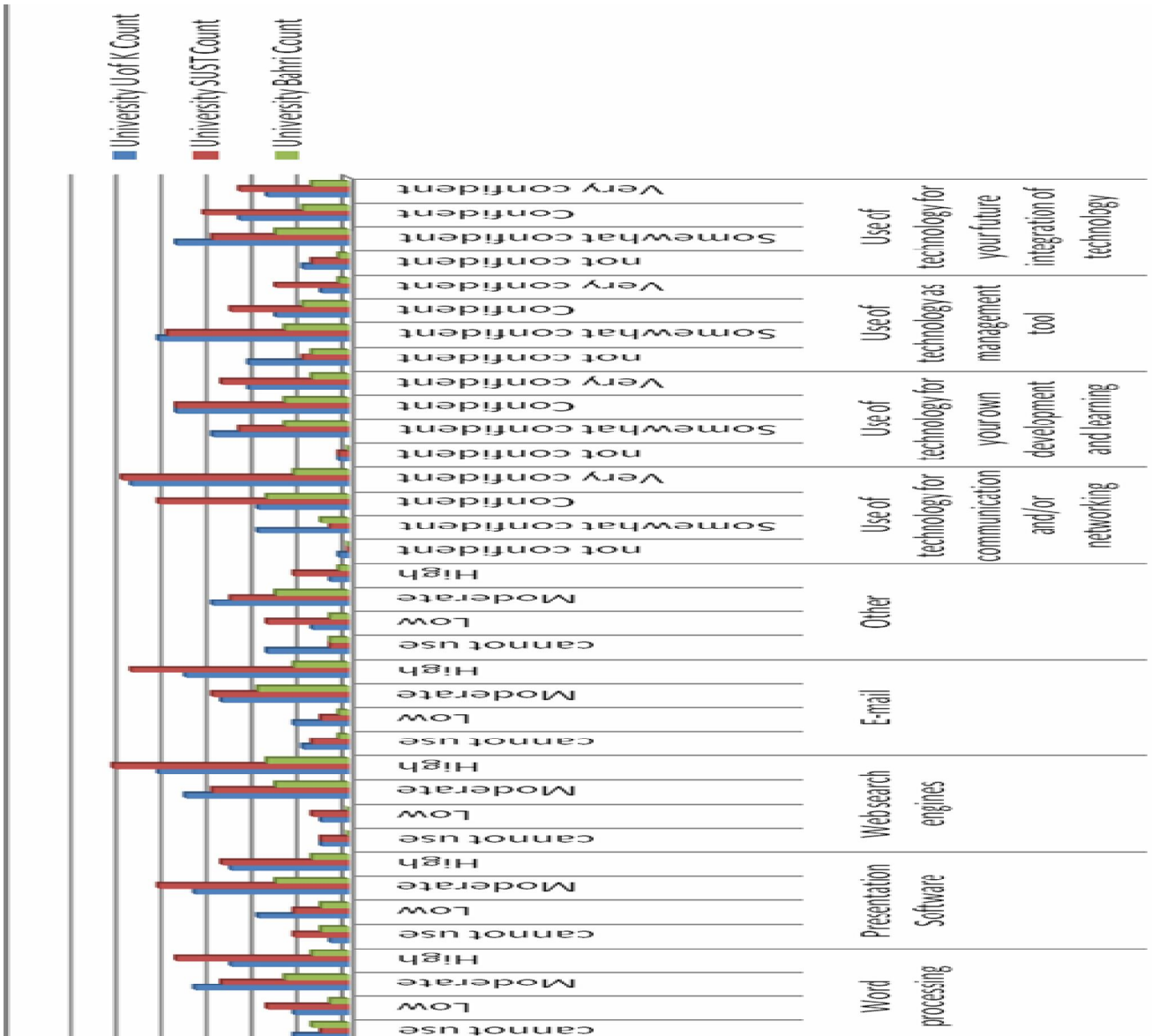


Table (12) student's skills level and confidence in the syllabi (technological skills and pedagogical use) with respect to universities:

		University		
		U of K	SUST	Bahri
Windows or other OS	Mean	2.87	3.29	2.89
File handling	Mean	3.05	3.20	3.22
Data bases	Mean	2.58	2.80	2.39
Spread sheets	Mean	2.87	2.52	2.47
Word processing	Mean	2.88	3.09	2.65
Presentation Software	Mean	2.98	2.91	2.72
Web search engines	Mean	3.27	3.33	3.53
E-mail	Mean	3.05	3.28	3.17
Other	Mean	2.33	2.77	2.62
Use of technology for communication and/or networking	Mean	3.27	3.48	3.17
Use of technology for your own development and learning	Mean	2.87	3.00	2.83
Use of technology as management tool	Mean	2.07	2.52	2.18
Use of technology for your future integration of technology	Mean	2.56	2.77	2.67

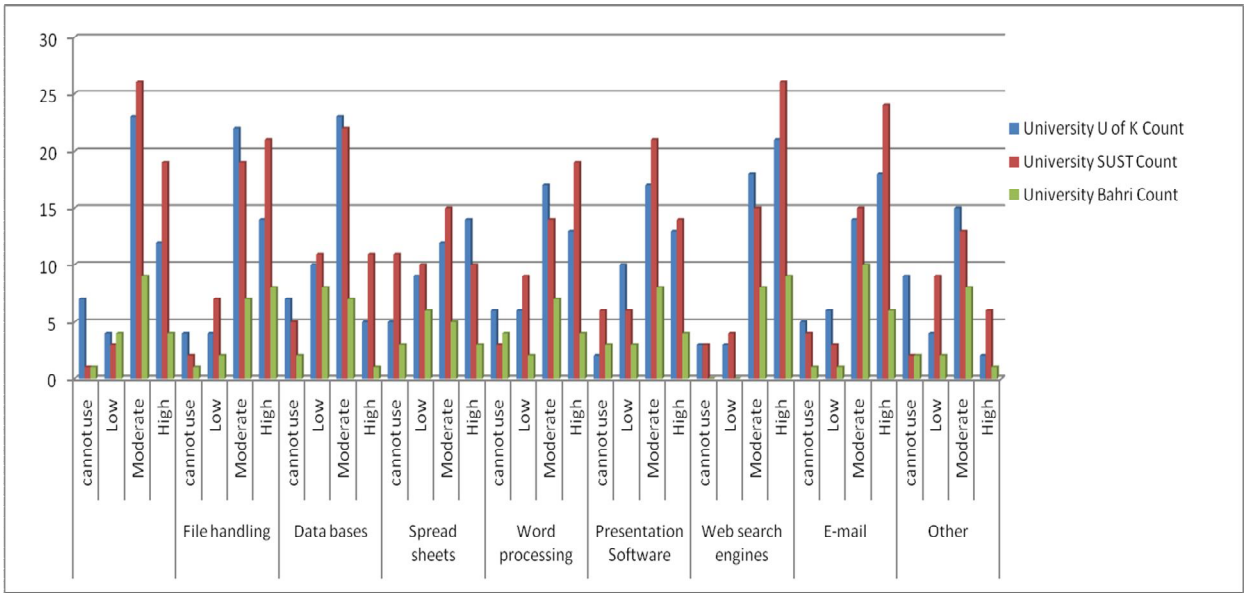


Figure 7 student's skills level and confidence in the syllabi (technological skills) with respect to universities

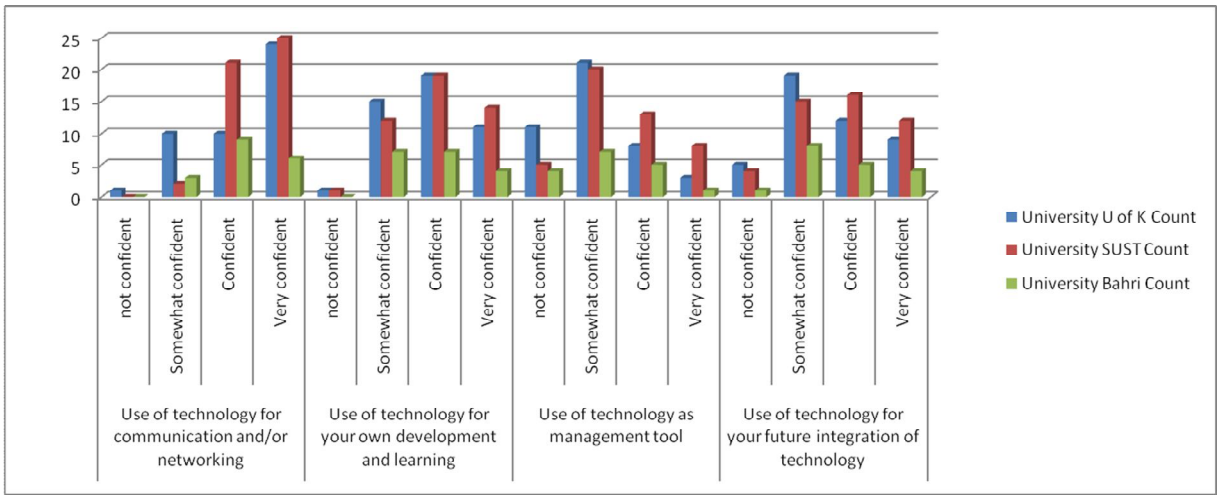


Figure 8 student's skills level and confidence in the syllabi (pedagogical use) with respect to universities

Key:

- For **student's skills level**, means (1.0-1.79 means cannot use, 1.8-2.59 means low skills, 2.6-3.39 means moderate skills and 3.4-4.0 means high skills)
- For **pedagogical,** means (1.0-1.7 means not confident, 1.8-2.5 means somewhat confident, 2.6-3.3 means confident and 3.4-4.0 is very confident)

Tables (11) and (12) and figures (7) and (8) above show that (most) of students in all universities have moderate skills in the ICT (2.6-3.3 in mean), and they are confident (2.6-3.3 in mean) to integrate technology in pedagogical

except in use of technology for communication and/or networking .The students of Sudan University of Science and Technology were very confident (3.48 in mean) and Use of technology for the future integration of technology. The students of all universities were somewhat confident (1.8-2.5 in mean), with no statistically significant differences between universities (all Sig > 0.05) in (technological skills and its pedagogical use).

Table (13) Frequencies distribution of kinds of technological equipment that student could use confidently:

Technological equipments		Responses		Percent of Cases
		N	Percent	
U of K	Personal computer	32	26.9%	72.7%
	Interactive white board	7	5.9%	15.9%
	video conferencing system	5	4.2%	11.4%
	Audio equipment	12	10.1%	27.3%
	Digital photo camera	11	9.2%	25.0%
	Digital video camera	7	5.9%	15.9%
	mobile phone	34	28.6%	77.3%
	Projection system	11	9.2%	25.0%
	Total	119	100.0%	270.5%
SUST	Personal computer	42	36.2%	91.3%
	Interactive white board	9	7.8%	19.6%
	video conferencing system	5	4.3%	10.9%
	Audio equipment	8	6.9%	17.4%
	Digital photo camera	10	8.6%	21.7%
	Digital video camera	10	8.6%	21.7%
	mobile phone	23	19.8%	50.0%
	Projection system	9	7.8%	19.6%
	Total	116	100.0%	252.2%
Bahri	Personal computer	17	25.0%	94.4%
	Interactive white board	6	8.8%	33.3%
	video conferencing system	1	1.5%	5.6%

	Audio equipment	6	8.8%	33.3%
	Digital photo camera	9	13.2%	50.0%
	Digital video camera	8	11.8%	44.4%
	mobile phone	16	23.5%	88.9%
	Projection system	5	7.4%	27.8%
	Total	68	100.0%	377.8%

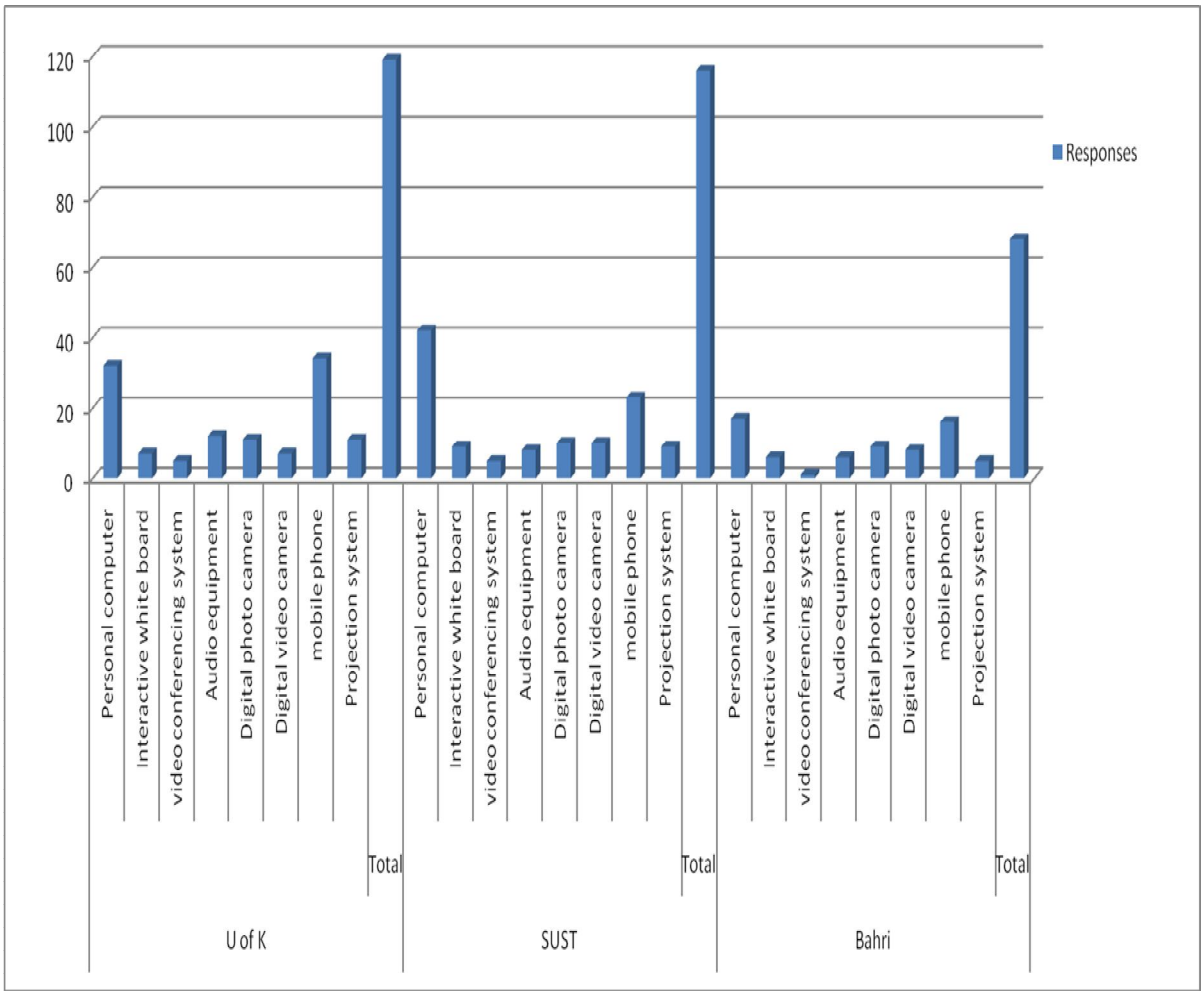


Figure 9 **Frequencies distribution of kinds of technological equipment that student could use confidently:**

tables (13) and figure (9) above shows that (Personal computer and mobile phone) are the most available equipment (26.9% and 28.6%), (36.2% and 19.8%), (25.0% and 23.5%) respectively for a universities, where (72.7% of U of K students could use PC confidently and 77.3% of them could use mobile phone confidently , 91.3% of SUST students could use PC confidently and 50% of could use mobile phone confidently, and 94.4% of Bahri university students could use PC confidently and 88.9%% of could use mobile phone confidently.

Table (14) Difficulties face the students with respect to university:

		University						**Pearson Chi-Square Tests**	
		U of K		SUST		Bahri			
		Count	N %	Count	N %	Count	N %		
Internet access is not easily accessible	Disagree	19	41.3%	15	31.2%	2	11.1%	Chi-square	9.472
	Neutral	13	28.3%	17	35.4%	4	22.2%	Df	4
	Agree	14	30.4%	16	33.3%	12	66.7%	Sig.	.049
We lack administrative support	Disagree	14	31.1%	12	25.0%	4	22.2%	Chi-square	14.917
	Neutral	18	40.0%	28	58.3%	3	16.7%	Df	4
	Agree	13	28.9%	8	16.7%	11	61.1%	Sig.	.005
We lack release time to learn, practice using computer or internet	Disagree	20	43.5%	17	35.4%	7	38.9%	Chi-square	6.471
	Neutral	19	41.3%	13	27.1%	7	38.9%	Df	4
	Agree	7	15.2%	18	37.5%	4	22.2%	Sig.	.167
We lack technical	Disagree	6	13.0%	9	18.8%	2	11.1%	Chi-square	3.843

support or advice	Neutral	7	15.2%	13	27.1%	3	16.7%	Df	4
	Agree	33	71.7%	26	54.2%	13	72.2%	Sig.	.428

Figure 10 Difficulties face the students with respect to university

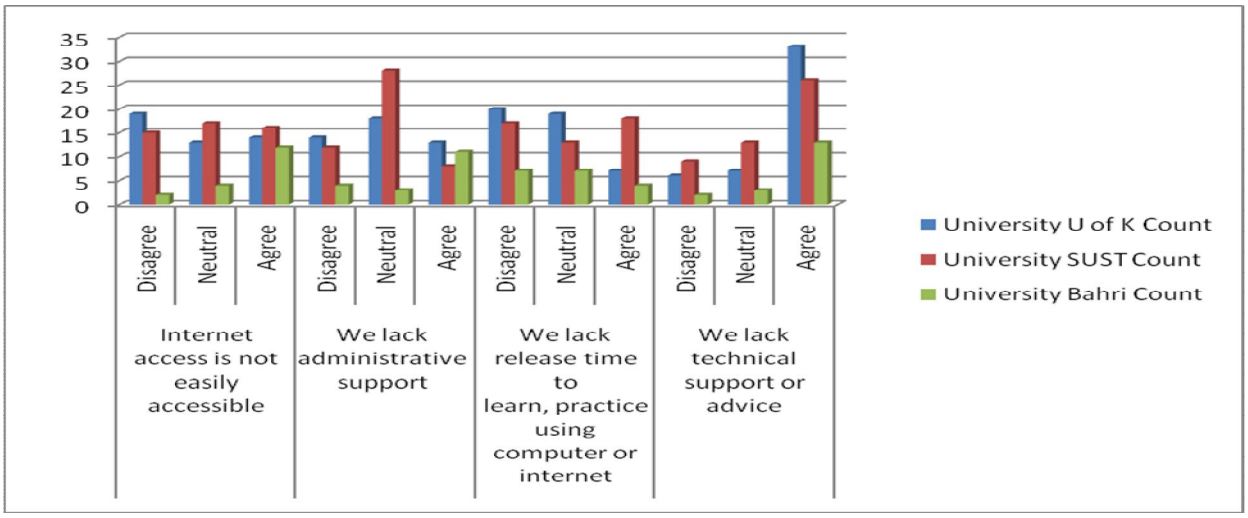


Table (14) and figure (10) above show that (30.4% , 33.3%) of the students of (University of Khartoum and Sudan university of Science and Technology) respectively, agree, that Internet access is not easily accessible compared with (66.7%) of students of Bahri university were disagree, (28.9% , 16.7%) of the students of (university of Khartoum and Sudan University of Science and Technology) respectively, agree that they lack administrative support compared with (61.1%) of students of Bahri university were disagree. While (15.2% , 37.5% and 22.2%) of them respectively agree that they lack release time to learn and practice using computer or internet. And (71.7% , 54.2% and 72.2%) of them respectively also agree that they lack technical support or advices, with statistically significant differences between universities (Sig = 0.049 and 0.005) < (0.05) in Internet accessible and administrative support, but no differences between universities (Sig = 0.167 and 0.428) < (0.05) in release time to learn, practice using computer or internet and technical support.

The interviews with the head departments show that the student teacher lack technical support, pedagogical support but the three universities provided internet access to the student teacher to different extent. Also, the objectives for the student teachers' pedagogical competence related to ICT is not clearly stated in course plans. Almost no money was spent on technological equipment (including maintenance) for student teachers in year 2015. Also, the three institution don't have a Learning management system (LMS), Virtual learning environment (VLE), e-portfolio system or equivalent. The observation also supported the interview's result.

4-3 Teachers trainers' questionnaire:

Table (15) the frequency distribution of trainers with respect to university:

	Frequency	Percent	Valid Percent	Cumulative Percent
U of K	4	33.3	33.3	33.3
SUST	4	33.3	33.3	66.7
Bahri	4	33.3	33.3	100.0
Total	12	100.0	100.0	

Figure 11 the frequency distribution of trainers with respect to university

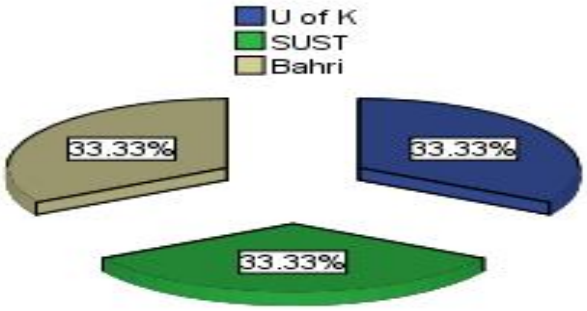


Table (15) and figure (11) above show that the same participation (33.3%) sample unit from each university.

Table (16) the frequency distribution of trainer qualification with respect to university:

Qualifications		Frequency	Percent	Valid Percent	Cumulative Percent
U of K	Master	2	50.0	50.0	50.0
	PhD	2	50.0	50.0	100.0
	Total	4	100.0	100.0	
SUST	Master	1	25.0	25.0	25.0
	PhD	3	75.0	75.0	100.0
	Total	4	100.0	100.0	
Bahri	PhD	4	100.0	100.0	100.0

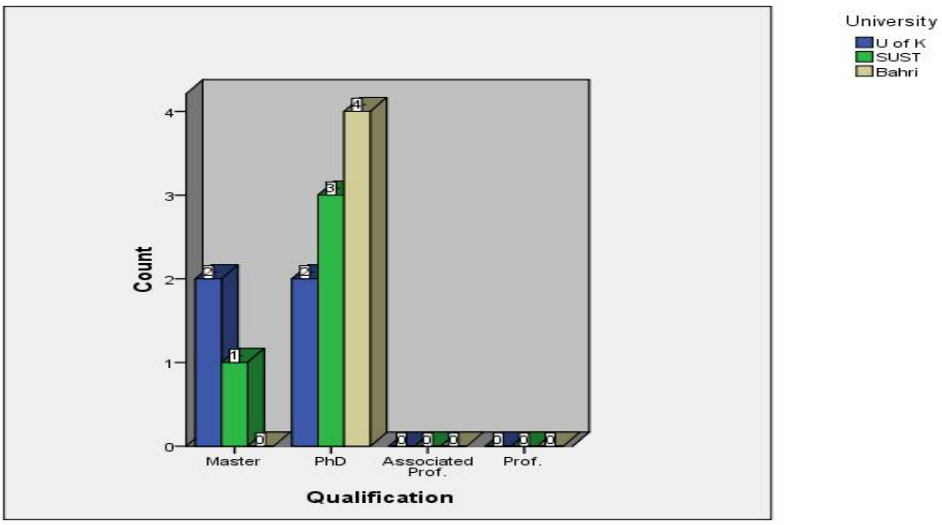


Figure (12) **the frequency distribution of trainer qualification with respect to university**:

Table (16) and (12) above shows that (50%) of the trainers in the University of Khartoum are Master's degree holder and (50%) of them are PhDs, since (25%)

of the trainers in Sudan University of Science and Technology are Master's degree holder and (75%) of them are PhDs, while all (100%) trainers in university of Bahri are PhDs.

Table (17) the frequency distribution of trainer experience with respect to university:

Experience		Frequency	Percent	Valid Percent	Cumulative Percent
U of K	Less than 5 Years	1	25.0	25.0	25.0
	5-10 Years	1	25.0	25.0	50.0
	More than 15 Years	2	50.0	50.0	100.0
	Total	4	100.0	100.0	
SUST	5-10 Years	2	50.0	50.0	50.0
	11-15 Years	1	25.0	25.0	75.0
	More than 15 Years	1	25.0	25.0	100.0
	Total	4	100.0	100.0	
Bahri	11-15 Years	2	50.0	50.0	50.0
	More than 15 Years	2	50.0	50.0	100.0
	Total	4	100.0	100.0	

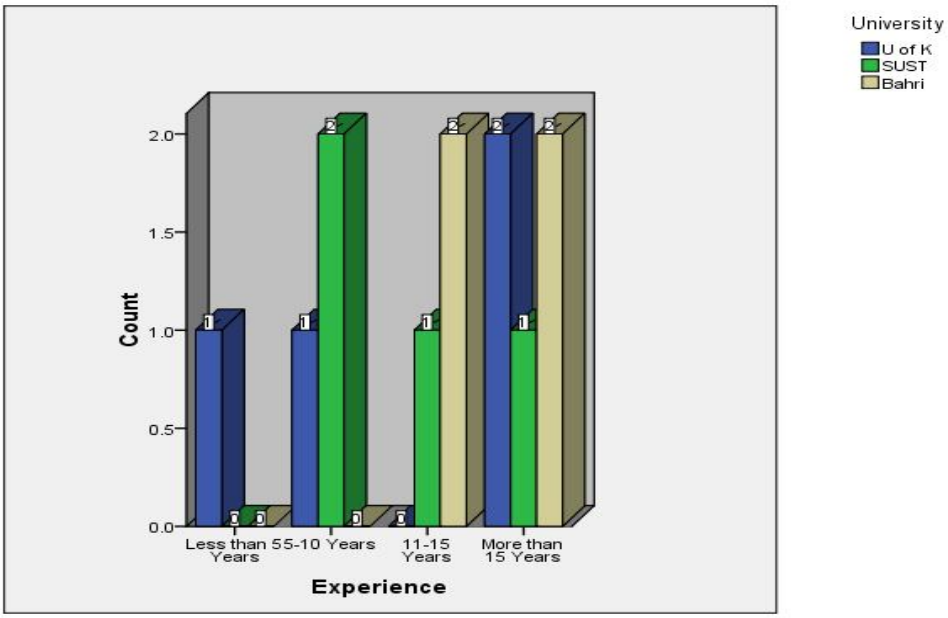


Figure 13 **the frequency distribution of trainer experience with respect to university**:

Table (17)and figure(13) above shows that (25%) of trainers in university of Khartoum have less than 5 years or 5-10 year experience , most of them (50%) have more than 15 years' experience, since(50%) of the trainers in Sudan University of Science and Technology have 5-10 year experience, (25%) have 11- 15 year and (50%) have more than 15 years' experience, while (50%) of trainers in university of Bahri have 5-10 year experience, (25%) have 11- 15 year and (50%) have more than 15 years' experience.

Table (18) Kind of equipment that available in the classroom:

		University						**Pearson Chi-Square Tests**	
		U of K		SUST		Bahri			
		Count	N %	Count	N %	Count	N %		
Personal Computer	In no Class	1	25.0%	2	50.0%	2	50.0%	Chi-square	8.400
	Upon Request	1	25.0%	0	.0%	0	.0%	df	6

	In Some Classes	2	50.0%	2	50.0%	0	.0%	Sig.	.210
	In All Classes	0	.0%	0	.0%	2	50.0%		
Interactive Wight Board	In no Class	4	100.0%	4	100.0%	4	100.0%	Chi-square	0
	Upon	0	.0%	0	.0%	0	.0%	df	.
	In Some Classes	0	.0%	0	.0%	0	.0%	Sig.	.
	In All Classes	0	.0%	0	.0%	0	.0%		
Video Conferencing System	In no Class	4	100.0%	4	100.0%	3	75.0%	Chi-square	2.182
	Upon Request	0	.0%	0	.0%	0	.0%	df	2
	In Some Classes	0	.0%	0	.0%	1	25.0%	Sig.	.336
	In All Classes	0	.0%	0	.0%	0	.0%		
Audio Equipment	In no Class	0	.0%	3	75.0%	2	50.0%	Chi-square	5.775
	Upon Request	1	33.3%	1	25.0%	0	.0%	df	4
	In Some Classes	2	66.7%	0	.0%	2	50.0%	Sig.	.217
	In All Classes	0	.0%	0	.0%	0	.0%		
Digital Photo Camera	In no Class	4	100.0%	3	75.0%	2	50.0%	Chi-square	3.667
	Upon Request	0	.0%	1	25.0%	1	25.0%	df	4
	In Some Classes	0	.0%	0	.0%	1	25.0%	Sig.	.453

	In All Classes	0	.0%	0	.0%	0	.0%		
Digital Video Camera	In no Class	4	100.0%	3	75.0%	2	50.0%	Chi-square	3.667
	Upon Request	0	.0%	1	25.0%	1	25.0%	df	4
	In Some Classes	0	.0%	0	.0%	0	.0%	Sig.	.453
	In All Classes	0	.0%	0	.0%	1	25.0%		
Mobile Phones	In no Class	3	100.0%	3	100.0%	2	66.7%	Chi-square	2.250
	Upon Request	0	.0%	0	.0%	1	33.3%	df	2
	In Some Classes	0	.0%	0	.0%	0	.0%	Sig.	.325
	In All Classes	0	.0%	0	.0%	0	.0%		
Project System	In no Class	0	.0%	0	.0%	0	.0%	Chi-square	14.400
	Upon Request	2	50.0%	0	.0%	0	.0%	df	4
	In Some Classes	1	25.0%	4	100.0%	0	.0%	Sig.	.006
	In All Classes	1	25.0%	0	.0%	4	100.0%		
Other	In no Class	2	50.0%	1	100.0%	2	100.0%	Chi-square	2.100
	Upon Request	1	25.0%	0	.0%	0	.0%	df	4
	In Some Classes	1	25.0%	0	.0%	0	.0%	Sig.	.717

	In All Classes	0	.0%	0	.0%	0	.0%		

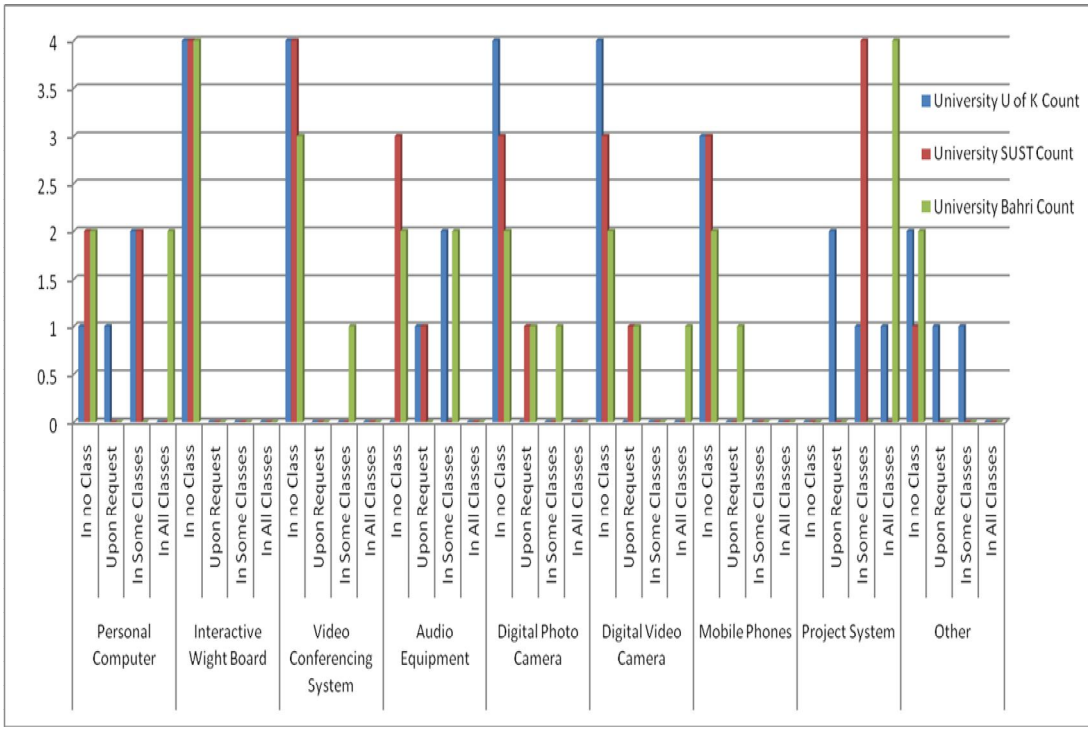


Figure 14 Kind of equipment that available in the classroom

Table (19) equipment availability in the classroom with respect to university

		university		
		U of K	SUST	Bahri
Personal Computer	Mean	2.25	2.00	2.50
Interactive Wight Board	Mean	1.00	1.00	1.00
Video Conferencing System	Mean	1.00	1.00	1.50
Audio Equipment	Mean	2.67	1.25	2.00
Digital Photo Camera	Mean	1.00	1.25	1.75
Digital Video Camera	Mean	1.00	1.25	2.00
Mobile Phones	Mean	1.00	1.00	1.33
Project System	Mean	2.75	3.00	4.00
Other	Mean	1.75	1.00	1.00

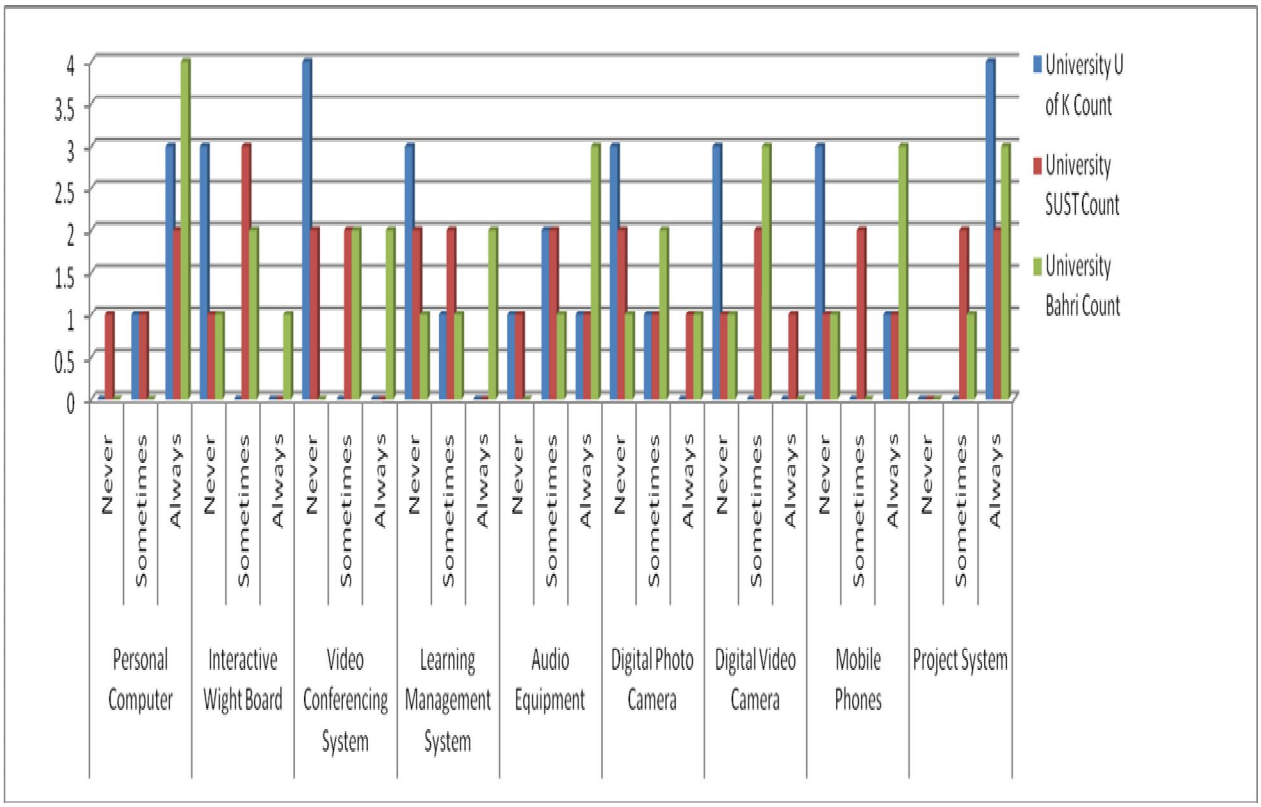


Figure 15 equipment availability in the classroom with respect to university

Key:

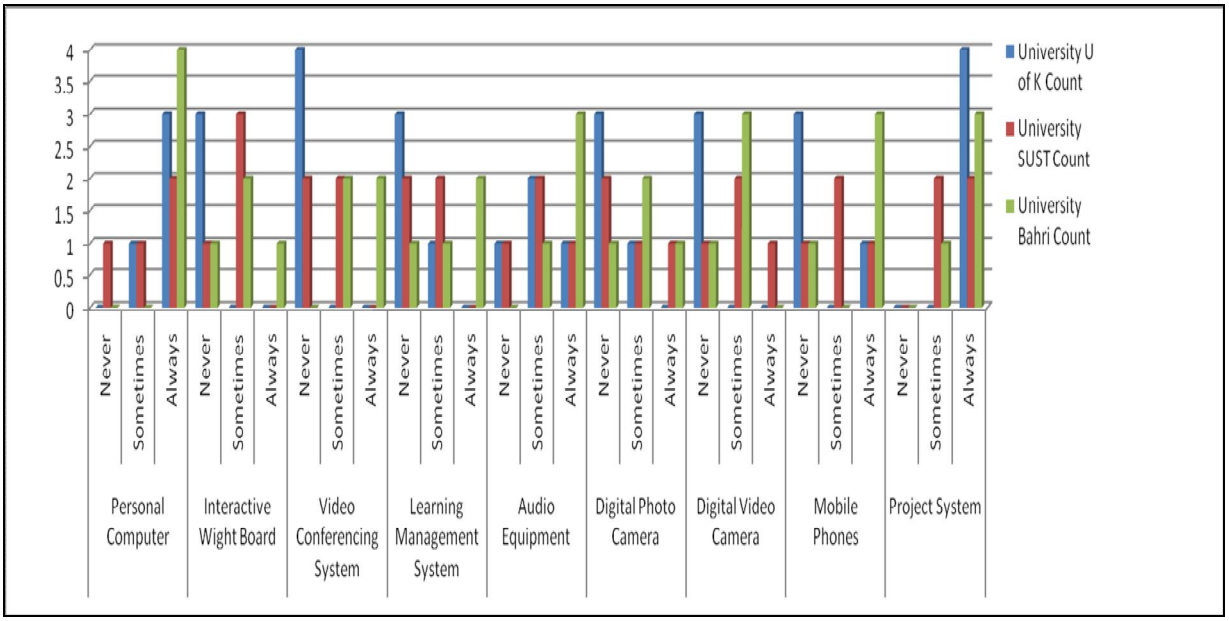
Means (1.0-1.79 is in no class, 1.8-2.59 is upon request, 2.6-3.39 is in some classes and 3.4-4.0 is in all classes)

Tables (18and19) and figures(14) and (15) above show that in all universities, **personal computer** is available upon request (1.8-2.59 in mean), but, Interactive White Board, Video Conferencing System, Digital Photo Camera, Mobile Phones and other equipment are unavailable in all classes (1.0-1.79 in mean). Audio Equipment is unavailable in all classes (1.0-1.79 in mean) in Sudan University of Science and Technology (1.0-1.79 in mean), while it is available in some classes at the University of Khartoum (2.6-3.39 in mean), and it is available upon request at Bahri university (1.8-2.59 in mean). Digital Video Camera is unavailable in all classes (1.0-1.79 in mean) at the university of Khartoum and Sudan University of Science and Technology, but available upon request at Bahri University (1.8-2.59 in mean). Project System is available in some classes (2.6-3.39 in mean) at the University of Khartoum and Sudan University of Science and Technology, but in all classes in Bahri University (3.4-4.0 in mean).With no statistically significant differences between universities (all Sig > 0.05) in (Infrastructures) except Project System (Sig < 0.05).

The observation supported the questionnaires' results. No equipments available in the three universities except computers and projectors. No interactive boards, digital cameras. Video conferencing systems, digital video cameras or audio equipments are available in the classrooms. Also the interview shows that the software is not available and what they have is not up to date.

Table (20) the frequency distribution of technological devices usage taught by trainers to their students with respect to universities:

Technological Devices		University					
		U of K		SUST		Bahri	
		Count	N %	Count	N %	Count	N %
Personal Computer	Never	0	.0%	1	25.0%	0	.0%
	Sometimes	1	25.0%	1	25.0%	0	.0%
	Always	3	75.0%	2	50.0%	4	100.0%
Interactive Wight Board	Never	3	100.0%	1	25.0%	1	25.0%
	Sometimes	0	.0%	3	75.0%	2	50.0%
	Always	0	.0%	0	.0%	1	25.0%
Video Conferencing System	Never	4	100.0%	2	50.0%	0	.0%
	Sometimes	0	.0%	2	50.0%	2	50.0%
	Always	0	.0%	0	.0%	2	50.0%
Learning Management System	Never	3	75.0%	2	50.0%	1	25.0%
	Sometimes	1	25.0%	2	50.0%	1	25.0%
	Always	0	.0%	0	.0%	2	50.0%
Audio Equipment	Never	1	25.0%	1	25.0%	0	.0%
	Sometimes	2	50.0%	2	50.0%	1	25.0%
	Always	1	25.0%	1	25.0%	3	75.0%
Digital Photo Camera	Never	3	75.0%	2	50.0%	1	25.0%
	Sometimes	1	25.0%	1	25.0%	2	50.0%
	Always	0	.0%	1	25.0%	1	25.0%
Digital Video Camera	Never	3	100.0%	1	25.0%	1	25.0%
	Sometimes	0	.0%	2	50.0%	3	75.0%
	Always	0	.0%	1	25.0%	0	.0%
Mobile Phones	Never	3	75.0%	1	25.0%	1	25.0%
	Sometimes	0	.0%	2	50.0%	0	.0%
	Always	1	25.0%	1	25.0%	3	75.0%
Project System	Never	0	.0%	0	.0%	0	.0%
	Sometimes	0	.0%	2	50.0%	1	25.0%
	Always	4	100.0%	2	50.0%	3	75.0%

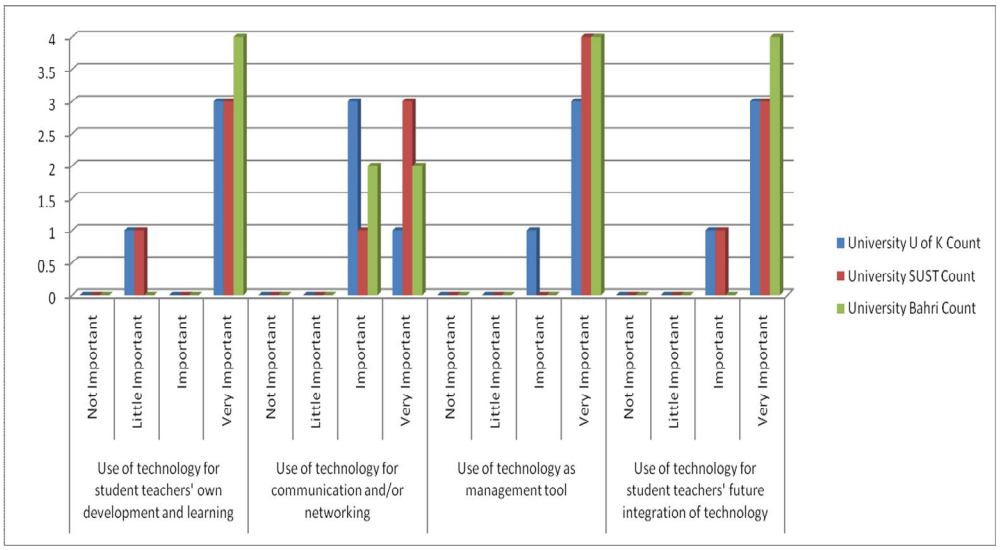


Figure(16) the frequency distribution of technological devices usage taught by trainers to their students with respect to universities

Table (20) and figure (16) above shows that most of trainers(75% , 50%) at (university of Khartoum and Sudan University of Science and Technology) respectively, always use (**PC**) compared with (100%) of trainers at Bahri University. (100% of the trainers at the three universities never used interactive white boards. (100%) of the trainers at the University of Khartoum never use Video Conferencing System comparing with (50% never use and 50% use it sometimes) at Sudan University of Science and Technology and (50% always use it and 50% use it sometimes) in Bahri university. Most of the trainers(75%) at the University of Khartoum never use Learning Management System comparing with (50% never use and 50% use it sometimes) at Sudan University of Science and Technology and (50% always use it and 25% use it sometimes or never) in Bahri university. (50% , 50%) of the trainers at the (University of Khartoum, Sudan University of Science and Technology) respectively, use Audio Equipment sometimes compared with (75%) of the trainers in Bahri university always use it. (75% , 50%) of the trainers at (university of Khartoum and Sudan University of Science and Technology) respectively, use Digital Photo Camera compared with (50%) of the trainers in Bahri university who always use it. (100%), all, the trainers at university of Khartoum never use Digital Video Camera comparing with (50% , 75%) of the trainers in (Sudan University of Science and Technology and Bahri university). (75%) of the trainers at University of Khartoum never use Mobile Phones comparing with (50%) of the trainers at Sudan University of Science and Technology use it sometimes and (75%) at Bahri university always use it. most trainers in all university always use Projectors.

Table (21) the importance of technology use to student teacher from the point of view of the trainers with respect to universities:

University						Technology use Importance	
Bahri		SUST		U of K			
N %	Count	N %	Count	N %	Count		
.0%	0	.0%	0	.0%	0	Not Important	Use of technology for student teachers' own development and learning
.0%	0	25.0%	1	25.0%	1	Little Important	
.0%	0	.0%	0	.0%	0	Important	
100.0%	4	75.0%	3	75.0%	3	Very Important	
.0%	0	.0%	0	.0%	0	Not Important	Use of technology for communication and/or networking
.0%	0	.0%	0	.0%	0	Little Important	
50.0%	2	25.0%	1	75.0%	3	Important	
50.0%	2	75.0%	3	25.0%	1	Very Important	
.0%	0	.0%	0	.0%	0	Not Important	Use of technology as management tool
.0%	0	.0%	0	.0%	0	Little Important	
.0%	0	.0%	0	25.0%	1	Important	
100.0%	4	100.0%	4	75.0%	3	Very Important	
.0%	0	.0%	0	.0%	0	Not Important	Use of technology for student teachers' future integration of technology
.0%	0	.0%	0	.0%	0	Little Important	
.0%	0	25.0%	1	25.0%	1	Important	
100.0%	4	75.0%	3	75.0%	3	Very Important	



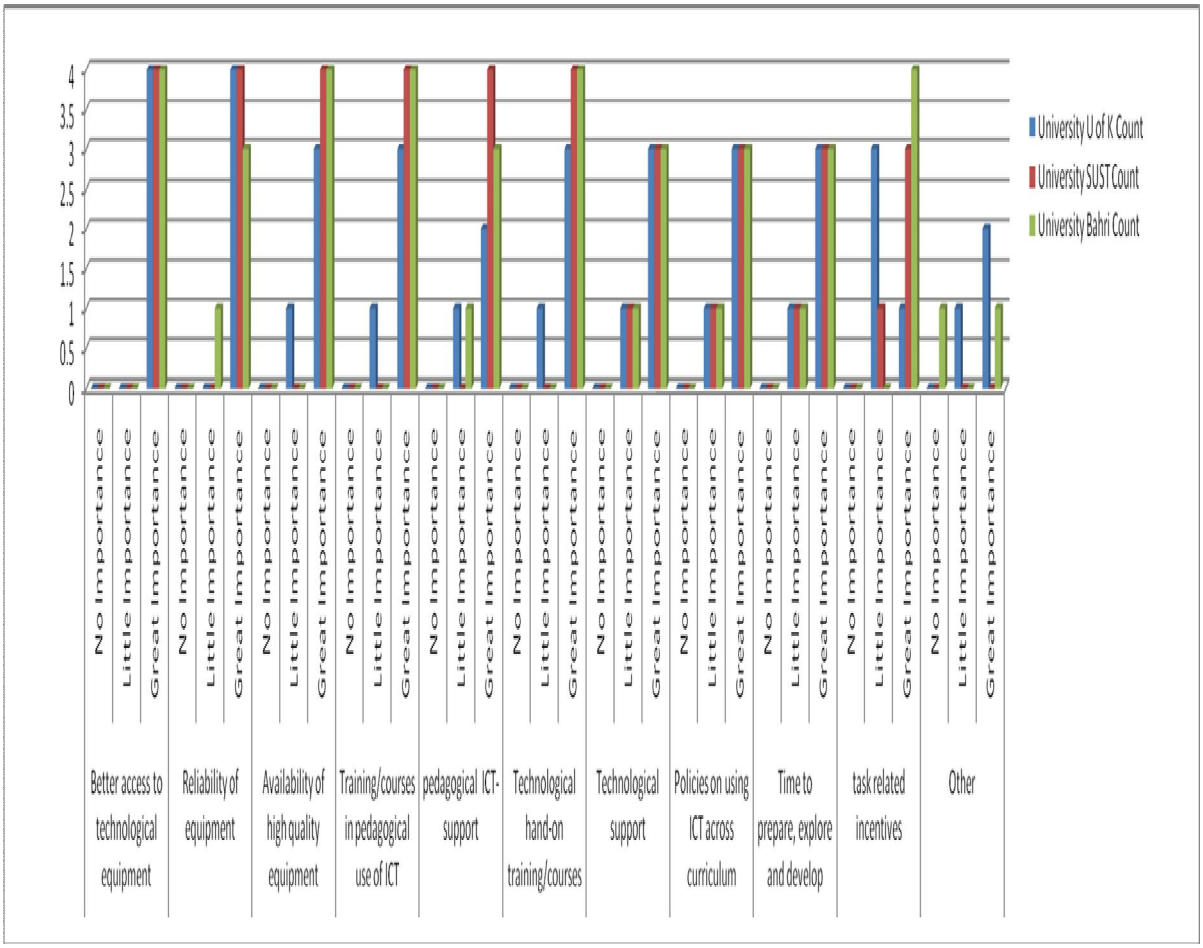
Figure(17) the importance of technology use to student teacher from the point of view of the trainers with respect to universities

Table (21) and figure (17) above show that the **use of technology for student teachers' own development and learning, and student teachers' future integration of technology** is very important for most of the trainers(75%) at (university of Khartoum and Sudan University of Science and Technology), while it is very important for, all, (100%) of the trainers at Bahri University. **Use of technology for communication and/or networking** is important for most of the trainers (75%) at the University of Khartoum, very important for (75%) at Sudan University of Science and Technology, while it is (50% important and 50% very important) for trainers at Bahri University. **Use of technology as management tool** is very important for (75%) of trainers in university of Khartoum, while it is very important for all (100%) trainers in Sudan University of Science and Technology and Bahri university).

Table (22) trainers' suggestions to help teacher trainers to integrate technology in their courses with respect to University:

		University					
Suggestions		U of K		SUST		Bahri	
		Count	N %	Count	N %	Count	N %
Better access to technological equipment	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	0	.0%	0	.0%	0	.0%
	Great Importance	4	100.0%	4	100.0%	4	100.0%
Reliability of equipment	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	0	.0%	0	.0%	1	25.0%
	Great Importance	4	100.0%	4	100.0%	3	75.0%
Availability of high quality equipment	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	1	25.0%	0	.0%	0	.0%
	Great Importance	3	75.0%	4	100.0%	4	100.0%
Training/courses in pedagogical use of ICT	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	1	25.0%	0	.0%	0	.0%
	Great Importance	3	75.0%	4	100.0%	4	100.0%
pedagogical ICT-support	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	1	33.3%	0	.0%	1	25.0%
	Great Importance	2	66.7%	4	100.0%	3	75.0%
Technological hand-on training/courses	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	1	25.0%	0	.0%	0	.0%
	Great Importance	3	75.0%	4	100.0%	4	100.0%
Technological support	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	1	25.0%	1	25.0%	1	25.0%
	Great Importance	3	75.0%	3	75.0%	3	75.0%
Policies on using ICT across	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	1	25.0%	1	25.0%	1	25.0%

curriculum	Great Importance	3	75.0%	3	75.0%	3	75.0%
Time to prepare, explore and develop	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	1	25.0%	1	25.0%	1	25.0%
	Great Importance	3	75.0%	3	75.0%	3	75.0%
task related incentives	No Importance	0	.0%	0	.0%	0	.0%
	Little Importance	3	75.0%	1	25.0%	0	.0%
	Great Importance	1	25.0%	3	75.0%	4	100.0%
Other	No Importance	0	.0%	0	.0%	1	50.0%
	Little Importance	1	33.3%	0	.0%	0	.0%
	Great Importance	2	66.7%	0	.0%	1	50.0%



Figure(18) **trainers' suggestions to help teacher trainers to integrate technology in their courses with respect to University**:

Table (22) and figure(18) above shows that (100%) of the trainers at University of Khartoum suggested, Better access to technological equipment and Reliability of equipment have great importance to help teacher trainers to integrate technology in their courses and most of them suggested that for (Availability of high quality equipment, Training/courses in pedagogical use of ICT, pedagogical ICT-support, Technological hand-on training/courses, Technological support, Policies on using ICT across curriculum, Time to prepare, explore and develop, task related incentives and Other). Also, (100%) of the trainers at Sudan University of Science and Technology suggested, (Better access to technological equipment, Reliability of equipment, Availability of high quality equipment,Training/courses in pedagogical use of ICT, pedagogical ICT-support and Technological hand-on training/courses) have great importance to help teacher trainers to integrate technology in their courses and most of them suggested that for (Technological support, Policies on using ICT across curriculum, Time to prepare, explore and develop and task related incentives). And (100%) of the trainers at Bahri University suggested, (Better access to technological equipment, Availability of high quality equipment, Training/courses in pedagogical use of ICT, Technological hand-on training/courses and task related incentives) have great importance to help teacher trainers to integrate technology in their courses and most of them suggested that for (Reliability of equipment, pedagogical ICT-support, Technological support, Policies on using ICT across curriculum and Time to prepare, explore and develop). We could note that trainers at (Sudan University of Science and Technology and Bahri University) were highly suggested than trainers at university of Khartoum.

The interviews show that the three institutions didn't have a major training program in technology for teacher trainers in the last two years. Also, no workshops or other learning activities about technological skills provided to

teacher trainers. No institution has a policy to promote or support ICT-based innovations by teacher trainers in their teaching. There is no special academic department dedicated to the pedagogical use of ICT at the three institutions. And no workshops or other learning activities about pedagogical use of ICT provided to teacher trainers.

4-4 Analysis and discussion of the data:

Here we are going to analyze and discuss the data provided by the survey questionnaires and interviews which are conducted with the respondent sample. The analysis and discussion is based on the research questions:.

4-4-1 What ICT infrastructures (equipment, software, access to internet etc. are available in the Sudanese colleges and faculties of education?

In order to prepare teachers capable to use ICT in secondary schools, the availability of the suitable ICT infrastructure is essential. Tables (14and15) above show that in all universities, **personal computer** is available upon request (1.8-2.59 in mean), but, Interactive White Board, Video Conferencing System, Digital Photo Camera, Mobile Phones and other equipment are unavailable in all classes (1.0-1.79 in mean). Audio Equipment is unavailable in all classes (1.0-1.79 in mean) in Sudan University of Science and Technology (1.0-1.79 in mean), while it is available in some classes at the University of Khartoum (2.6-3.39 in mean), and it is available upon request at Bahri university (1.8-2.59 in mean). Digital Video Camera is unavailable in all classes (1.0-1.79 in mean) at the university of Khartoum and Sudan University of Science and Technology, but available upon request at Bahri University (1.8-2.59 in mean). Project System is available in some classes (2.6-3.39 in mean) at the University of Khartoum and Sudan University of Science and Technology, but in all classes in Bahri University (3.4-4.0 in mean).With no statistically significant differences between universities (all Sig > 0.05) in (Infrastructures) except Project System (Sig < 0.05).

The observation supported the questionnaires' results. No equipments available in the three universities except computers and projectors. No interactive boards, digital cameras. Video conferencing systems, digital video cameras or audio equipments are available in the classrooms. Also the interview shows that the software is not available and what they have is not up to date.

Also the interviews supported the questionnaires and the observation. The number of computers available is not enough, almost no money spent on equipments during 2015(Five thousand which isUS$300 spent at Khartoum University and less US$100 spent at the University of Bahri).

The most commonly available software is that of word processing, power point, spread sheets, data base and operating systems and not subject software.

Table (8) above shows that (30.4% , 33.3%) of the students of (University of Khartoum and Sudan university of Science and Technology) respectively, agree, that Internet access is not easily accessible compared with (66.7%) of students of Bahri university were disagree,

4-4-2 Are the syllabi appropriate and up to date?

Tables (6) and (7) above show that (most) of students in all universities have moderate skills in the ICT (2.6-3.3 in mean), and they are confident (2.6-3.3 in mean) to integrate technology in pedagogical except in use of technology for communication and/or networking .The students of Sudan University of Science and Technology were very confident (3.48 in mean) in the use of technology for the future integration of technology. The students of all universities were somewhat confident (1.8-2.5 in mean), with no statistically significant differences between universities (all Sig > 0.05) in (technological skills and its pedagogical use).

tables (8) above shows that (Personal computer and mobile phone) are the most available equipment (26.9% and 28.6%), (36.2% and 19.8%), (25.0% and 23.5%) respectively for a universities, where (72.7% of U of K students could

use PC confidently and 77.3% of them could use mobile phone confidently , 91.3% of SUST students could use PC confidently and 50% of could use mobile phone confidently, and 94.4% of Bahri university students could use PC confidently and 88.9%% of could use mobile phone confidently.

Table (17) shows that the use of technology for student teachers' own development and learning, and student teachers' future integration of technology is very important for most of the trainers(75%) at (university of Khartoum and Sudan University of Science and Technology), while it is very important for, all, (100%) of the trainers at Bahri University. Use of technology for communication and/or networki**ng** is important for most of the trainers (75%) at the University of Khartoum, very important for (75%) at Sudan University of Science and Technology, while it is (50% important and 50% very important) for trainers at Bahri University. Use of technology as management tool is very important for (75%) of trainers in university of Khartoum, while it is very important for all (100%) trainers in Sudan University of Science and Technology and Bahri university).

So we can conclude that the syllabuses are concentrating mainly on the operating systems, word processing, power point, data base, spread sheets and administration uses of the computers and not the pedagogical uses and it is very important according to the trainers to include the pedagogical aspect and the uses of different devices(interactive white boards, video conferencing system, video cameras, digital cameras, projectors, and mobile learning) must be added to the syllabuses, too.

4-4-3Are the trainers ready to train the teachers?

The trainers' development and readiness are useful benchmark to evaluate the status the colleges of education in preparing student teacher to use ICT in their future.

Table (18) shows that (100%) of the trainers at University of Khartoum suggested, Better access to technological equipment and Reliability of equipment have great importance to help teacher trainers to integrate technology in their courses and most of them suggested that for (Availability of high quality equipment, Training/courses in pedagogical use of ICT, pedagogical ICT-support, Technological hand-on training/courses, Technological support, Policies on using ICT across curriculum, Time to prepare, explore and develop, task related incentives and Other). Also, (100%) of the trainers at Sudan University of Science and Technology suggested, (Better access to technological equipment, Reliability of equipment, Availability of high quality equipment, Training/courses in pedagogical use of ICT, pedagogical ICT-support and Technological hand-on training/courses) have great importance to help teacher trainers to integrate technology in their courses and most of them suggested that for (Technological support, Policies on using ICT across curriculum, Time to prepare, explore and develop and task related incentives). And (100%) of the trainers at Bahri University suggested, (Better access to technological equipment, Availability of high quality equipment, Training/courses in pedagogical use of ICT, Technological hand-on training/courses and task related incentives) have great importance to help teacher trainers to integrate technology in their courses and most of them suggested that for (Reliability of equipment, pedagogical ICT-support, Technological support, Policies on using ICT across curriculum and Time to prepare, explore and develop). We could note that trainers at (Sudan University of Science and Technology and Bahri University) were highly suggested than trainers at university of Khartoum.

The interviews show that the three institutions didn't have a major training program in technology for teacher trainers in the last two years. Also, no workshops or other learning activities about technological skills provided to teacher trainers. No institution has a policy to promote or support ICT-based

innovations by teacher trainers in their teaching. Also, there is no special academic department dedicated to the pedagogical use of ICT at the three institutions. And no workshops or other learning activities about pedagogical use of ICT provided to teacher trainers.

4-4-4 What are the challenges and problems face Sudanese colleges and faculties of education to do so?

Table (5) show that (84.8% , 89.8% and 82.4%) of the students of the University of Khartoum, Sudan University of Science and Technology and University of Bahri respectively, match love the ICT, (84.8% , 72.9%and77.8%) of them were agree that using ICT in education is an urgent need, (58.7% , 43.8%and 44.4%) of them prefer teaching with ICT and (71.1% , 63.3%and 77.8%) of them needs more training to use ICT in teaching.

Obviously that the students of all universities love the ICT, agree that its usage in education is an urgent need and they prefer teaching with ICT, but still need more training, with no statistically significant differences between universities (Sig = .661 , .731 , .426and .602) >> (0.05) in students' attitudes towards ICT.

Table (9) above shows that (30.4% , 33.3%) of the students of (University of Khartoum and Sudan university of Science and Technology) respectively, agree, that Internet access is not easily accessible compared with (66.7%) of students of Bahri university were disagree, (28.9% , 16.7%) of the students of (university of Khartoum and Sudan University of Science and Technology) respectively, agree that they lack administrative support compared with (61.1%) of students of Bahri university were disagree. While (15.2% , 37.5% and 22.2%) of them respectively agree that they lack release time to learn and practice using computer or internet. And (71.7% , 54.2% and 72.2%) of them respectively also agree that they lack technical support or advices, with statistically significant differences between universities (Sig = 0.049 and 0.005) < (0.05) in Internet accessible and

administrative support, but no differences between universities (Sig = 0.167 and 0.428) < (0.05) in release time to learn, practice using computer or internet and technical support.

The interviews with the head departments show that the student teacher lack technical support, pedagogical support but the three universities provided internet access to the student teacher to different extent. Also, the objectives for the student teachers' pedagogical competence related to ICT is not clearly stated in course plans. Almost no money was spent on technological equipment (including maintenance) for student teachers in year 2015. Also, the three institution don't have a Learning management system (LMS), Virtual learning environment (VLE), e-portfolio system or equivalent. The observation also supported the interview's result.

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Chapter5

Summary of the findings of the study, Conclusions and Recommendations

5-1 **Introduction**

This chapter presents a summary of the findings and conclusions drawn from the study and proposes recommendation. The results of this study provide a useful overview of three colleges of education. The findings and conclusions are generalized to the population of the study (The Sudanese colleges of education).

The purpose of this study is to investigate the current status of colleges of education in Khartoum State and its readiness to prepare teachers capable to use ICT in secondary education.

This study has drawn from the conceptualization and design of the UNESCO ICT Competency Framework for Teachers.

The research findings were presented according to the following research questions:

The main research questions:

Are Sudanese colleges and faculties of education infrastructures, syllabuses and trainers ready to prepare well trained teachers to integrate ICT in secondary education?.

-What are the challenges and problems face Sudanese colleges and faculties of education to do so?

The sub –research questions are:

- What ICT infrastructures (equipment, software, access to internet etc. are available in the Sudanese collages and faculties of education?
- Are the syllabi appropriate and up to date?
-Are the trainers ready to train the teachers?
- What are the challenges and problems face Sudanese colleges and faculties of education to do so?

5-2 Summary of the Findings of the study:

This section presents a summary of findings that were established from the previous chapters with respect to the purpose, objectives and the research questions that guided the study. Insight from the literature is also presented.

5-2-1 ICT Infrastructure at the colleges of education:

1- Colleges need more equipment (more computers, interactive white boards, digital cameras, digital video cameras, video conferencing systems, VLS (virtual Learning Systems, Etc.

2- Colleges need more accurate more reliable equipment.

3- The subjects' coverage software is not available only computer science subject(word processing, excel, power point, ..etc.) is used to train the student teachers.

4- Internet access is not available for student teacher at two universities out of three-the sample.

5-2-2 Syllabuses

1- The syllabuses are not up to date, most of the students can't use the Technological devises confidently. Also, they concentrated on computer science subjects, and administration uses of computers.

2- The pedagogical aspect is almost absent in the syllabuses. The subjects' coverage

Software is not available but only computer science software. So teachers' trainers

5-2-3 Teachers' Trainers

1- Teachers' trainers need training courses in technological and pedagogical aspects

. The interviews show that the three institutions didn't have a major training program in technology for teacher trainers in the last two years. Also, no workshops or other learning activities about technological skills provided to

teacher trainers. No institution has a policy to promote or support ICT-based innovations by teacher trainers in their teaching. Also, there is no special academic department dedicated to the pedagogical use of ICT at the three institutions. And no workshops or other learning activities about pedagogical use of ICT provided to teacher trainers.

2- Teachers' trainers don't have pedagogical and technological support.

(100%) of the trainers suggested, (Better access to technological equipment, Availability of high quality equipment, Training/courses in pedagogical use of ICT, Technological hand-on training/courses and task related incentives) have great importance **to help teacher trainers to integrate technology in their courses and most of them** suggested that pedagogical ICT-support, Technological support, Policies on using ICT across curriculum and Time to prepare, explore and develop).is very important, too.

3- Teachers' trainers need time and financial support.

Most of teachers' trainers suggested that pedagogical ICT-support, Technological support, Policies on using ICT across curriculum and Time to prepare, explore and develop) is very important.

5-2-4Challenges and problems face Sudanese colleges and faculties of education.

1- The equipments are not enough and not up to date.

2- No policies or budgets to update the equipments, syllabuses and pay for trainers' development.

3- Lack of technical, pedagogical and administration support

5-3 Conclusion:

The conclusions of this study are based on the findings presented in section 5-2. The researcher generalized the findings of the study sample to the whole population (the colleges of education in Khartoum state).

This study presents data and information that will enable the policymakers to make judgments on the current situation regarding the use of ICT and will help them to take new steps to utilize ICT in teachers' pre-service training and the future integration of ICT in secondary education.

The conclusions of this study are summarized in three main conclusions followed by some evidences which generated from the findings:

5-3-1 Sudanese colleges and faculties of education do not have the necessary infrastructure to prepare student teacher to use ICT in secondary education. The evidences were:

1- Colleges need more equipment (more computers, interactive white boards, digital cameras, digital video cameras, video conferencing systems, VLS (virtual Learning Systems, Etc.

2- Colleges need more accurate more reliable equipment.

3- The subjects' coverage software is not available only computer science subject(word processing, excel, power point, ..etc.) is used to train the student teachers.

4- Internet access is not available for student teacher at two universities out of three-the sample.

5-3-2 Teachers trainers need more training, support and time to be ready to prepare student teachers to use ICT in secondary education. The evidence were:

1- Teachers' trainers need training courses in technological and pedagogical aspects.

2- Teachers' trainers don't have pedagogical and technological support.

3- Teachers' trainers need time and financial support.

5-3-3 Syllabuses are not appropriate and not up to date.

1- Most of the students can't use the Technological devices confidently.

2- Syllabuses are concentrated on computer science subjects, and administration uses of computers.

3- The pedagogical aspect is almost absent in the syllabuses. The subjects' coverage

Software is not available but only computer science software.

.

5-4 Recommendations:

1- Supply the colleges of education with more accurate and reliable equipment (interactive white boards, video digital cameras, video cameras, video conferencing system, Projectors, etc.

2- Provide subject coverage software.

3- Update the syllabuses. Students teachers should learn how to use the technological devices, how to run and use programs, how to use them to teach their own subjects, use ICT as a management tool for their own development , and for future integration.

4- More training for teachers' trainers. Training courses in technological and pedagogical aspects, workshops and other learning activities about technological skills and pedagogical use of ICT, and policies to promote and support ICT-based innovations by teacher trainers in their teaching.

5- Provide technical and pedagogical support for both teachers trainers' and students teacher.

6- Polices and budgets to update equipments, syllabuses and pay for trainers' development.

7- More money and time for teachers' trainers.

5-4-2 Suggestions for further research:

1- ICT for online teachers' training

2- ICT in pre-school and basic education

3- The impact of implementing ICT in education on the national development.

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Appendixes:

Appendix (A) Teachers' trainer's questionnaire

In the name of Allah

Sudan University of Science and Technology

Post Graduate Collage

Faculty of Education – Educational Technology Department

Questionnaire - Teacher Trainers

This research is titled (The Readiness of colleges of Education to Prepare Teachers to use ICT in Secondary Education)This questionnaire is for you teacher trainers and that is to decide according to your answers To what extent are Sudanese colleges ready to Prepare teachers to use ICT in secondary education. So please tick carefully the appropriate choice according to your point of view and according to your knowledge and experiences putting in mind that we are going to use this information to develop the educational process.

Thank you for cooperating. We are going to use this information for scientific purpose only.

The researcher

Background information

1- Institution: …….

2- Qualifications:

Master ☐ PhD ☐ associated prof ☐ Prof ☐

3. What subject area(s) do you teach in teacher training?

……

4. For how many years have you been teaching in teacher training?

☐ Less than 5 yrs
☐ 5-10 yrs
☐ 1o-15 yrs
☐ More than 15 yrs

Infrastructure:

5. What kind of technological equipment is available in the classrooms you use?	In no class-	In some classrooms	In all class-rooms	Upon re-quest

Syllabi

6. Do you teach the use of the technological devices below to student teachers?	Never	Sporadically	In about half of my classes	In every class

…with parents				
...with school management and educational administrations				
7. To what extent do you think the use of technology	Not	Little	Quite	Very
b) Use of technology for student teachers' own development and learn- ing	impor-	impor-	impor-	impor-
c) Use of technology as a management tool…				
…for organising their work and keep records				
…for preparing lessons				
…for finding digital learning resources				
…for designing and producing their own digital learning resources				
d) Student teachers' future integration of technology…				
…to facilitate teaching specific concepts or skills				
…to support various student learning styles and to personalise learning				
...to facilitate teaching pupils with disabilities (cognitive, physical, be- havioral)				
…to support activities that facilitate higher-order thinking				
…to support creativity				
…to foster pupils' ability to use technology in their own learning	□	□	□	□
Other (please specify below):	□	□	□	□

Pedagogical Use

Suggestions

8. What importance do you attach to the following suggestions to help teacher	No importance	Little importance	great importance	Very great importance
Better access to technological				
eliability of equipment				
Availability of high quality	□	□	□	□
Training/courses in pedagogical	□	□	□	□
Pedagogical ICT-support (e.g.	□	□	□	□
Technological hands-on	□	□	□	□
Technological support (e.g.	□	□	□	□
Policies on using ICT across	□	□	□	□
Time to prepare, explore and	□	□	□	□
Task related incentives (salary,	□	□	□	□
Other (please specify)	□	□	□	□

Appendix (B) Students teacher questionnaire:

Bismillah

Sudan University of Science and Technology

Post Graduate Collage

Faculty of Education – Educational Technology Department

Questionnaire

This research is titled (The Readiness of colleges of Education to prepare Teachers for the use ICT in Secondary Education) This questionnaire is for you-student teacher. So please tick carefully the appropriate choice according to your point of view and according to your knowledge and experiences putting in mind that we are going to use this information to develop the educational process.

Thank you for cooperating. We are going to use this information for scientific purpose only.

The researcher

1- Background Information

University ……..

Computer experience

Poor ☐ **good** ☐ **very good** ☐ **Excellent** ☐

2- The student teacher's attitudes towards ICT

- Do you have PC at home.
Yes ☐ **No** ☐
I love ICT **Agree** ☐ **Neutral** ☐ **disagree** ☐
- Using ICT in education is an urgent need **Agree** ☐ **Neutral** ☐ **disagree** ☐
I prefer teaching without ICT **Agree** ☐ **Neutral** ☐ **Disagree** ☐

To what extent do you feel confident to integrate technology in the following areas? confident to integrate technol- ogy in the following areas?	Not confident dent at all	Somewhat confident	Confident	Very Confident
a) Use of technology for communication and/or networking				
with your pupils				
…with friends				
…with school management and educational administrations				
b) Use of technology for your own development and learning				
c) Use of technology as a management tool..				
…for organising your work and keep records				
…for preparing lessons				
…for finding digital learning resources				
…for designing and producing your own digital learning re- sources				
d) Your future integration of technology…				
…to facilitate teaching specific concepts or skills				
…to support various student learning styles and to personalize learning				
…to facilitate teaching pupils with disabilities (cognitive, physical, behavioural)				
…to support activities that facilitate higher-order thinking				
…to support creativity				
…to foster pupils' ability to use technology in their learning				
Other (please specify below):				

3- The Syllabi

Please indicate your skill level in the following:

	(1) Cannot Use/None	(2) Low	(3 Moderate	4) High
a) Windows or other Operating systems				
b) File handling (Creating/opening files, etc)				
c) Databases				
d) Spreadsheets				
e) Word Processing				
f) Presentation Software				
g) Web Search Engines (Google, etc.)				
h) Web Authoring tools				
i) Other: **Please specify:**				

4- The infrastructure

6. What kind of technological equipment is available in the classrooms you use: please tick:

- **Personal computers**
- **Interactive whiteboards**
- **Video conferencing systems**
- **Audio equipment (including software)**
- **Digital photo cameras (including editing software)**
- **Digital video cameras (including editing software)**

Mobile phones Projection syste
- 6- Difficulties **- Internet access is not easily accessible.** **Agree** ☐ **Neutral** ☐ **disagree** ☐ -
- We lack administrative support. **Agree** ☐ **Neutral** ☐ **disagree** ☐ -
- We lack release time to learn, practice using computers or Internet. **Agree** ☐ **Neutral** ☐ **disagree** ☐ -
-We Lack technical support or advice. **Agree** ☐ **Neutral** ☐ **disagree** ☐

Appendix (C) ICT

UNESCO ICT TEACHER COMPETENCY FRAMEWORK MODULES

UNESCO ICT Competency Framework for Teacher

Technology Literacy

The policy goal of this approach is to enable learners, citizens and the workforce to use ICT to support social development and improve economic productivity. Related educational goals include increasing school enrolments, making high-quality resources available to all, and improving basic literacy skills, including technology literacy.

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 1 UNDERSTANDING ICT IN EDUCATION

Policy Awareness With this approach, programmes make direct connections between policy and classroom practices.

Teachers must be aware of policies and be able to articulate in consciously skilled ways how their classroom practices correspond to and support policy.

MODULE 2 CURRICULUM AND ASSESSMENT

Basic Knowledge Changes in the curriculum entailed by this approach often include improving basic literacy skills through technology and adding the development of ICT skills in different contexts, which will involve incorporating in other subjects a range of relevant ICT resources and productivity tools.

Teachers must have an excellent knowledge of the curriculum standards for their subject, as well as knowledge of standard assessment strategies. In addition, teachers must be able to integrate the use of technology into the curriculum.

MODULE 3 PEDAGOGY

Integrate Technology Changes in pedagogical practice involve the integration of various technologies, tools, and digital content as part of

whole class, group, and individual student activities to support didactic instruction.

Teachers must know where, with whom, when (as well as when not) and how to use ICT for classroom activities and presentations.

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

TL.1.a. Identify key characteristics of classroom practices and specify how these characteristics serve to implement policies.

Engage participants in a discussion of both national policies and common classroom practices. Identify the characteristics of practices that support policy. Have participants identify and analyze their own classroom practices in terms of policy.

TL.2.a. Match specifi c curriculum standards to particular software packages and computer applications and describe how these standards are supported by these applications.

Select a range of software packages in a specifi c subject area; have participants identify specifi c curriculum standards that are associated with these packages and discuss how these are supported by the applications.

TL.3.a. Describe how didactic teaching and ICT can be used to support students' acquisition of school subject matter knowledge.

Describe how the use of ICT and specifi c types of software can support students' acquisition of school subject matter knowledge and demonstrate ways in which the use of this technology can supplement didactic classroom teaching (i.e., lecture and demonstration teaching).

TL.3.b. Incorporate appropriate ICT activities into lesson plans so as to support students' acquisition of school subject matter knowledge.

Have participants design lesson plans that incorporate tutorial and drill and practices software, and digital resources. Have participants share these plans and receive recommendations from peers.

TL.3.c. Use presentation software and digital resources to support instruction.

Demonstrate the use of presentation software and other digital media to supplement a lecture; provide a variety of examples of instructional presentations; have participants create a lesson plan that includes the use of presentation software; have participants use presentation software to design a presentation.

UNESCO ICT Competency Framework for Teachers

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 4 ICT

Basic Tools The technologies involved in this approach include the use of computers along with productivity software; drill and practice software, tutorials, and web content; and the use of networks for management purposes

Teachers must know basic hardware and software operations, as well as productivity applications software, a web browser, communications software, presentation software, and management applications.

Technology Literacy

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

TL.4.a. Describe and demonstrate the use of common hardware.

Discuss and demonstrate the basic operation of various types of hardware, such as desktop computers, laptops, printers, scanners and hand-held devices.

TL.4.b. Describe and demonstrate the basic tasks and uses of word processors, such as text entry, editing text, formatting text and printing.

Discuss and demonstrate the basic tasks of word processors, demonstrate how they are used in instruction. Have participants create a text document in which they carry out these basic word processing tasks to generate a text document.

TL.4.c. Describe and demonstrate the purpose and basic features of presentation software and other digital resources.

Discuss the purpose of presentation software and demonstrate its general features and functions. Have participants create a presentation on a topic of their choice using digital resources.

TL.4.d. Describe the purpose and basic function of graphics software and use a graphics software package to create a simple graphic display.

Discuss the purpose of graphics software and demonstrate the creation of a graphics display. Have participants create and share a graphic display.

TL.4.e. Describe the Internet and the World Wide Web, elaborate on their uses, describe how a browser works and use a URL to access a website.

Discuss the purpose and structure of the Internet and the World Wide Web and participants' experiences of them. Demonstrate the use of a browser; have participants use a browser to access popular websites.

TL.4.f. Use a search engine. Demonstrate the use of a search engine; discuss and demonstrate simple keyword searches; have participants search for websites on their favourite topics and discuss the keyword strategies they used with the group for discussion. TL.4.g. Create an email account and use it for a sustained series of email correspondence. Demonstrate the creation and use of an email account; have participants create an email account and create and send a series of email messages.

TL.4.h. Describe the function and purpose of tutorial and drill and

practice software and how it supports students' acquisition of knowledge of school subjects. Demonstrate a variety of tutorial and drill and practice packages in the subjects which the participants teach and describe how such packages support the acquisition of subject matter knowledge. Have participants analyze specifi c packages in their subject area and describe how they support the acquisition of specifi c subject matter knowledge. TL.4.i. Locate off-the-shelf educational software packages and web resources, evaluate them for their accuracy and alignment with curriculum standards, and match them to the needs of specifi c students. Have participants search websites and catalogues to identify appropriate software for specifi ed learning objectives or standards and analyze these packages for accuracy and curriculum alignment. Have participants discuss the criteria they used for analyzing and evaluating the software.

Technology Literacy

UNESCO ICT Competency Framework for Teachers

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 4 ICT continued...

MODULE 5 ORGANIZATION AND ADMINISTRATION

Standard Classroom Little change in social structure of the class occurs in this approach other than, perhaps, the spatial placement and integration into the lesson of technology resources in the classroom or in labs.

Teachers must be able to use technology with the whole class, small groups, and individual activities and ensure equitable access is provided to all students.

MODULE 6 TEACHER PROFESSIONAL LEARNING

Digital Literacy The implications of this approach for teacher education focus on the development of digital literacy and the use of ICT for professional improvement.

Teachers must have the technological skill and knowledge of web resources necessary to use technology to acquire additional subject matter and pedagogical knowledge in support of their own professional learning.

Technology Literacy

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

TL.4.j. Use networked record keeping software to take attendance, submit grades, and maintain student records.

Discuss the purposes and advantages of a networked recording keeping system, demonstrate the use of such a system, and have participants enter record keeping data for their class.

TL.4.k. Use common communication and collaboration technologies, such as text messaging, video conferencing, and web-based collaboration and social environments.

Discuss the purposes and advantages of various communication and collaboration technologies; and have participants use these technologies to communicate and collaborate with others in the group.

TL.5.a. Integrate the use of a computer laboratory into ongoing teaching activities.

Discuss and give examples of different ways that computer laboratories (or a set of classroom laptops) can be used to supplement classroom teaching; have participants create lesson plans that include the use of computer laboratory activities

TL.5.b. Manage the use of supplemental ICT resources with individuals and small groups of students in the regular classroom so as not to disrupt other instructional activities in the class.

Discuss and give examples of different ways that limited classroom ICT resources can be use by individual students, pairs, or small groups to supplement teaching; have participants create lesson plans that include the use of ICT to supplement classroom teaching.

TL.5.c. Identify the appropriate and inappropriate social arrangements for using various technologies.

Identify different hardware and software technologies and discuss corresponding social arrangements appropriate for their instructional use, such individuals, pairs, small groups, and large groups.

TL.6.a. Use ICT resources to enhance their productivity.

Discuss different tasks that occupy participants' time during the work day; discuss how ICT resources can be used to help with these tasks and enhance productivity; have participants use desktop computers, laptops, handheld devices, and software, such as a word processor, blogs, wikis, or other productivity and communication tools to help with one of the identifi ed tasks.

TL.6.b. Use ICT resources to support their own acquisition of subject matter and pedagogical knowledge.

Discuss different ICT resources that participants can use to increase their subject matter and pedagogical knowledge; have participants identify a personal professional learning goal and create a plan for the use of various ICT tools to accomplish this goal, such as web browsers and communication technologies. TL.6.c. Identify and manage Internet safety issues. Discuss cyber bullying; appropriate information to post; predators; communication forums; privacy and piracy issues; viruses; scams; spam; cookies; pop-ups; intellectual property rights, copyright, inappropriate content; digital citizenship; email etiquette; ethics; legal requirements; confi dentiality of personal data; password issues. Have participants develop appropriate strategies and procedures to deal with these issues.

Technology Literacy

UNESCO ICT Competency Framework for Teachers

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 1 UNDERSTANDING ICT IN EDUCATION

Policy Understanding. This approach often requires teachers to understand policies so they can design lesson plans to implement national policies and address high-priority problems.

Teachers must have an in-depth knowledge of national policies and social priorities, and be able to design, modify, and implement classroom practices that support these policies.

MODULE 2 CURRICULUM AND ASSESSMENT

Knowledge Application. This approach often requires changes in the curriculum that emphasize depth of understanding over coverage of content, and assessments that emphasize the application of understanding to realworld problems and social priorities. Assessment change focuses on complex problem-solving and embeds assessments into the ongoing activities of the class.

Teachers must have a deep knowledge of their subject and the ability to apply it fl exibly in a variety of situations. They must also be able to create complex problems whose solutions measure students' understanding.

MODULE 3 PEDAGOGY

Complex Problem Solving. Classroom pedagogy associated with this approach includes collaborative problem- and project-based learning in which students explore a subject deeply and bring their knowledge to bear on complex, every-day questions, issues, and problems.

Teaching is student-centred in this approach and the teacher's role is to provide direct instruction in consciously skilled ways and to structure problem tasks, guide student understanding, and support student collaborative projects. In this role teachers must have the skills to help students create, implement,

and monitor project plans and solutions. In addition teachers need to use assessment for learning as a basic principle guiding their practice.

Knowledge Deepening

The policy goal of this approach is to increase the ability of the workforce to add value to economic output by applying the knowledge of school subjects to solve complex problems encountered in real world situations at work and in life generally.

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

KD.1.a. Explain and analyze the principles of using ICT in education. Describe how these principles can be put into practice in their own teaching. Analyse what issues arise in implementing these principles and how those issues can be addressed.

Consider what issues arise in implementing the ICT CFT principles in a school. Identify opportunities for implementation and potential obstacles. Analyze the advantages and disadvantages of different approaches to implementing ICT policy objectives.

KD.2.a. Identify key concepts and processes in the subject area, describe the function and purpose of subject-specifi c tools and how they support students' understanding of these key concepts and processes and their application to the world outside the classroom.

Demonstrate a variety of software packages in the subject area (such visualizations in science, data analysis packages in mathematics, role-play simulations in social studies, and references resources in language).Engage with an expert online, visit an online museum, or run a web based simulation, and describe how these support student understanding of key concepts in the subject and their application to solve complex problems. Have participants

analyze specifi c packages in their subject area and describe how they support concepts and complex problem solving in a learner-centred environment.

KD.2.b. Develop and apply knowledge- and performance-based rubrics that allow teachers to assess students' understanding of key subject matter concepts, skills, and processes.

Discuss characteristics of student responses and products of different levels of quality. Develop rubrics that convey these characteristics and examine examples of such assessment rubrics. Have participants generate and apply rubrics to sample products, such as student reports of results of a chemistry experiment.

KD.3.a. Describe how collaborative, project-based learning and ICT can support student thinking and social interaction, as students come to understand key concepts, processes, and skills in the subject matter and use them to solve real-world problems.

Describe how the use of ICT and specific types of software can support students' understanding and application of subject matter knowledge and ways in which the use of this technology can support project-based learning. Generate and discuss different examples, such as: └ student teams' becoming marine biologists or oceanographers using the web and applying concepts to identify ways of protecting ecological systems └ student teams in social studies using presentation software and applying concepts of government to advocate a position with the local council Include collaboration via online dialogues or real time communication with experts.

UNESCO ICT Competency Framework for Teachers

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 3 PEDAGOGY continued...

MODULE 4 ICT

Complex Tools. To understand key concepts, students employ open-ended technology tools that are specifi c to their subject area, such as visualizations

in science, data analysis tools in mathematics or role play simulations in social studies.

Teachers must be knowledgeable about a variety of subject-specifi c tools and applications and be able to fl exibly use these in a variety of problem-based and project-based situations. Teachers should be able to use network resources to help students collaborate, access information and communicate with external experts in order to analyze and solve their selected problems. Teachers should also be able to use ICT to create and monitor individual and group student project plans.

Knowledge Deepening

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

KD.3.b. Identify or design complex, real-world problems and structure them in a way that incorporates key subject matter concepts and serves as the basis for student projects.

Discuss characteristics of authentic world problems that incorporate key concepts; examine examples of such problems; have participants generate examples, such as the need to improve crop productivity or to market a product.

KD.3.c. Design online materials that support students' deep understanding of key concepts and their application to real world problems.

Analyze online materials to identify key features of the materials that support deep understanding. Have participants work in groups to design an online unit that supports the understanding of key concepts and the development of related skills in the subject area.

KD.3.d. Design unit plans and classroom activities so that students engage in reasoning with, talking about, and using key subject matter concepts while

they collaborate to understand, represent, and solve complex real-world problems, as well as to refl ect on and communicate solutions.

Discuss characteristics of activities that engage students in project-based learning; examine examples of such activities; have participants generate units and activities in their subject areas, such as the use of physics concepts to strengthen homes against earthquakes or the use of fractions to create an equitable distribution of resources.

KD.3.e. Structure unit plans and classroom activities so that open-ended tools and subject-specifi c applications will support students in their reasoning with, talking about, and use of key subject matter concepts and processes while they collaborate to solve complex problems.

Discuss characteristics of activities that employ openended digital tools and applications to engage students in project-based learning; examine examples of such activities, tools and applications; have participants generate and demonstrate units in their subject area, such as the use of a computer simulation and social studies concepts to understand the factors and dynamics involved in the expansion of a settlement or the use of a graphics package to illustrate ideas expressed in a poem.

KD.3.f. Implement collaborative, project-based unit plans and classroom activities, while providing guidance to students towards the successful completion of their projects and attainment of deep understanding of key concepts.

Discuss the role of teachers and the strategies they use during the implementation of collaborative, project- based units. Have participants demonstrate the use of strategies and digital resources to support the implementation of their units.

KD.4.a. Operate various open-ended software packages appropriate to their subject matter area, such as visualization, data analysis, role-play simulations, and online references.

Demonstrate the use of a variety of software packages in a subject domain; have participants explore and demonstrate these packages.

Knowledge Deepening

UNESCO ICT Competency Framework for Teachers

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 4 ICT continued...

MODULE 5 ORGANIZATION AND ADMINISTRATION

Collaborative Groups Class periods and classroom structure are more dynamic, with students working in groups for extended periods of time.

Teachers must be able to create fl exible classroom learning environments. Within these environments, teachers must be able to integrate student-centred activities and fl exibly apply technology to support collaboration.

Knowledge Deepening

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

KD.4.b. Evaluate the accuracy and usefulness of web resources in support of project-based learning in a subject area.

Have participants search websites and catalogues to identify appropriate software for project-based learning in their subject fi eld. Have participants develop evaluation criteria and rubrics and justify their selections based on effectiveness for the intended purpose.

KD.4.c. Use an authoring environment or tools to design online materials.

Demonstrate the use of an authoring environment or tools. Have participants work in groups to design an online unit of a course of study.

KD.4.d. Use a network and appropriate software to manage, monitor, and assess progress of various student projects.

Demonstrate the use of networked project software that allows the teacher to manage, monitor, and assess student project work; have participants enter project data for their students' work.

KD.4.e. Use ICT to communicate and collaborate with students, peers, parents and the larger community in order to nurture student learning

Discuss the use of online communication and collaboration environments by teachers to support student learning; have participants keep a log, share printouts, and demonstrate examples of their online interactions, in this regard.

KD.4.f. Use the network to support student collaboration within and beyond the classroom.

Discuss the use of online communication and collaboration environments by students to support their collaborative project work and learning; have participants keep a log, share printouts, and demonstrate examples of student online interactions.

KD.4.g. Use search engines, online databases, and email to fi nd people and resources for collaborative projects.

Discuss the use of search engines, online databases, and email to fi nd people and resources for collaborative projects; have participants conduct searches related to a project for their course; engage in an online collaborative project; have participants refl ect on their experiences, share them with others and discuss them.

KD.5.a. Place and organize computers and other digital resources within the classroom so as to support and reinforce learning activities and social interactions.

Examine and discuss different classroom arrangements of computers and other digital resources in terms of the ways these confi gurations support or inhibit student participation and interaction; have participants design

arrangements of classroom resources and discuss the rationale for their designs.

KD.5.b. Manage student project-based learning activities in a technology-enhanced environment.

Discuss ways to manage student technology-based classroom activities during project work; have participants discuss their unit plans in terms of classroom management with a focus on the advantages and disadvantages of various confi gurations.

Knowledge Deepening

UNESCO ICT Competency Framework for Teachers

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 6 TEACHER PROFESSIONAL LEARNING

Manage and Guide. The implications of this approach for teacher professional learning focus on the use of ICT to guide students through complex problems and manage dynamic learning environments.

Teachers must have the skills and knowledge to create and manage complex projects, collaborate with other teachers, and make use of networks to access information, colleagues and outside experts in supporting their own professional learning.

Knowledge Deepening

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

KD.6.a. Use ICT to access and share resources to support their activities and their own professional learning.

Discuss the various sources of online information and other resources that can be used to support professional learning; have participants conduct online

searches for materials that support their professional learning goals; have them share and discuss the results of these searches and plans for implementation.

KD.6.b. Use ICT to access outside experts and learning communities to support their activities and their own professional learning.

Discuss the various sources of online experts and communities that can support professional learning; have participants conduct online searches for such experts and communities; have them communicate with experts and participate in communities and then share and discuss the results of these activities.

KD.6.c. Use ICT to search for, manage, analyze, integrate and evaluate information that can be used to support their professional learning.

Discuss the importance of developing knowledge management skills related to the analysis of online resources, integrating them into practice, and evaluating their quality; have participants describe, discuss, and demonstrate examples of their practices in this regard.

Knowledge Deepening

UNESCO ICT Competency Framework for Teachers

Knowledge Creation

The policy goal of this approach is to increase productivity by creating a workforce that is continually engaged in, and benefi ts from, knowledge creation, social development and cultural development.

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 1 UNDERSTANDING ICT IN EDUCATION

Policy Innovation. With this approach, teachers and school staff are active participants in the continuous evolution of education reform policy.

Teachers must understand the intentions of national policies and be able to contribute to the discussion of education reform policies and participate in the design, implementation, and revision of programmes intended to implement these policies.

Knowledge Society Skills. With this approach the curriculum goes beyond a focus on knowledge of school subjects to explicitly include the Knowledge Society skills such as problem solving, communication, collaboration, and critical thinking. Students will also need to be able to determine their own learning goals and plans. Assessment is itself a part of this process; students must be able to assess the quality of their own and each others' products.

Teachers must know about complex human development, such as cognitive, emotional and physical development. They must know how, and under which conditions, students learn best, and teachers must anticipate and be able to effectively respond to the diffi culties students encounter. Teachers must have the skills required to support these complex processes.

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

KC.1.a. Design, implement, and modify school-level education reform programmes that implement key elements of national education reform policies.

Discuss the intentions of national education reform policies and ways that they could be implemented in school level programmes. Have participants work in teams to design a school level programme that would implement a component of national reform policy. Have participants implement an initial phase of this programme, evaluate progress, and share challenges and strategies for overcoming challenges.

KC.2.a. Identify and discuss how students learn and demonstrate complex cognitive skills, such as information management, problem solving, collaboration and critical thinking.

Discuss the characteristics of complex cognitive thought processes and how students acquire and demonstrate these. Have participants identify the use of these skills in their own work. Have participants explicitly incorporate the acquisition and demonstration of one or more of these skills in a lesson plan. Have participants refl ect on implementing the lesson plan and offer suggestions for improvement.

KC.2.b. Help students to use ICT to acquire the skills of searching for, managing, analyzing, evaluating and using information.

Discuss characteristics of effective information-search and information-management skills, and how ICT-based learning activities can support the development and demonstration of these skills; have participants generate examples of such activities.

KC.2.c. Design units of study and classroom activities that integrate a range of ICT tools and devices to help students acquire the skills of reasoning, planning, refl ective learning, knowledge building and communication.

Discuss characteristics of reasoning, planning and knowledge building skills and discuss how ICT-based learning activities can support these skills; have participants generate and share examples of such activities. Have participants critique units of study and offer suggestions for additional resources.

KC.2.d. Help students to use ICT to develop communications and collaboration skills.

Discuss characteristics of communication and collaboration skills and how technology-based learning activities can support these skills; have participants generate examples of such activities. Have participants model effective communication and collaboration through participation in virtual professional learning communities.

KC.2.e. Help students develop both knowledge- and performance-based rubrics and apply them to assess their own understanding of key subject

matter and ICT skills. Help students to use these rubrics to assess other students' work.

Discuss characteristics of self- and peer-assessment and of the knowledge- and performance-based rubrics used to refl ectively assess one's own learning and that of others; have participants generate and evaluate examples of such activities and rubrics. Have participants develop knowledge- and performance-based rubrics that increase expectations for extending and expanding learning of key subject matter and ICT skills and concepts through the integration of emerging technologies.

UNESCO ICT Competency Framework for Teachers

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 3 PEDAGOGY

Self Management. Students work in a learning community in which they are continuously engaged in creating knowledge products and building upon their own and each other's knowledge and skills.

The role of teachers in this approach is to explicitly model the learning processes and create situations in which students apply their developmental skills.

MODULE 4 ICT

Pervasive Technology. Various networked devices, digital resources and electronic environments are used to create the production of knowledge and 'anytime-anywhere' collaborative learning.

Teachers must be able to design ICT-based knowledge communities and use ICT to support the development of students' knowledge creation skills and their continuous, refl ective learning.

Knowledge Creation

UNESCO ICT Competency Framework for Teachers

OBJECTIVES TEACHERS SHOULD BE ABLE TO

EXAMPLE METHODS (FOR TEACHER EDUCATION OR PROFESSIONAL LEARNING)

KC.3.a. Explicitly model their own reasoning, problem solving and knowledge-creation while teaching students.

Have participants build on the discussion of their own cognitive skills to externalize and overtly demonstrate the use of these skills to solve problems in their subject area. Have participants share their strategies and processes for solving problems and creating new knowledge with peers.

KC.3.b. Design online materials and activities that engage students in collaborative problem-solving, research or creating art.

Discuss characteristics of online materials that support students in the design and planning of their own learning activities; have participants work in teams to generate and evaluate online materials. Have participants model online collaborative problemsolving, research, or art in a professional learning community.

KC.3.c. Help students design project plans and activities that engage them in collaborative problem-solving, research, or artistic creation.

Discuss characteristics of teacher activities that support students in the design and planning of their own learning activities; have participants generate and demonstrate examples of such activities.

KC.3.d. Help students incorporate multimedia production, web production and publishing technologies into their projects in ways that support their ongoing knowledge production and communication with other audiences.

Discuss characteristics of teacher activities that support students in the use of various production technologies in their own learning activities; have participants generate examples of such activities; have participants demonstrate examples of multimedia production, web production, and publishing technologies to support student publishing in online professional learning communities.

KC.3.e. Help students refl ect on their own learning.

Discuss characteristics of teacher activities that support students' refl ective learning; have participants generate examples, share their refl ections, and critique other's work in a professional learning community.

KC.4.a. Describe the function and purpose of ICT production tools and resources (multimedia recording and production equipment, editing tools, publication software, web design tools) and use them to support students' innovation and knowledge creation.

Demonstrate a variety of software packages and digital production resources and describe how they support and advance students' innovation and knowledge creation practices. Have participants analyze specifi c examples of use of these resources in their subject area and describe how they support student innovation and knowledge creation. Have participants use and evaluate these tools in a unit that they design.

Knowledge Creation

UNESCO ICT Competency Framework for Teachers

Knowledge Creation

CURRICULAR GOALS TEACHER COMPETENCIES

MODULE 5 ORGANIZATION AND ADMINISTRATION

Learning Organizations. Schools are transformed into learning organizations in which all actors are involved in the learning process.

Teachers should be able to play a leadership role in training and providing follow-up support to colleagues and in creating and implementing a vision of their school as a community based on innovation and continuous learning enriched by ICT.

MODULE 6 TEACHER PROFESSIONAL LEARNING

Teacher as Model Learner. From this perspective, teachers are themselves master learners and knowledge producers who are constantly engaged in

educational experimentation and innovation to produce new knowledge about learning and teaching practice.

Teachers, too, must have the ability, motivation, inclination, encouragement and support to experiment, continuously learn and use ICT to build professional learning communities working toward creating knowledge.

Appendix (d)

Administrators' Interview

Please indicate the job title(s) or relevant responsibilities

……..

Technology equipment

1- How many computers are available at the institution for the student teachers to use?.

……

2- . How much money was spent on technological equipment (including maintenance) for student teachers in year 2014?

……

3- Does the institution have a Learning management system (LMS), Virtual learning environment (VLE), e-portfolio system or equivalent? Yes/No

4- Does the institution provide Internet access to the student teachers? Yes/No

5- Are the software available and up to date?

6- Does the institution have broadband access to the Internet? Yes/No

7- . Does the institution have a Wi-Fi network? Yes/No

Technological skills

8- Are workshops or other learning activities about technological skills provided to teacher trainers? Yes/ No

9- Has the institution had a major training program in technology for teacher trainers in the last two years? Yes/No

10- Is technical support provided for student teachers at your institution? Yes / No

Pedagogical skills related to ICT

11- . Does the institution have a policy to promote or support ICT-based innovations by teacher trainers in their teaching? Yes/No

12- Is there a special academic department dedicated to the pedagogical use of ICT at your institution? Yes/No

13- Are workshops or other learning activities about pedagogical use of ICT provided to teacher trainers?

Yes / No

14- . Are the objectives for the student teachers' pedagogical competence related to ICT clearly stated in course plans?

Yes / No

15- Is pedagogical support provided for student teachers at your institution?