
IMPACT OF INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) ON HIGHER EDUCATIONAL SYSTEM IN SIERRA LEONE – A SURVEY

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ABSTRACT

In Sierra Leone, higher educational institutions to date lack equipment, infrastructure, and quality electronic learning materials. ICT has not yet become a catalyst for transformational change in the educational system. Most of the efforts to embrace ICT in the national education system have proved futile due to high cost of acquisition of necessary equipment by the users and lack of adequate investment in the national ICT infrastructure. The objective of this paper is in two-folds. First, to examine the current state of ICT use and e-learning, especially as it relates to its impact on teaching and learning. Second, to identify potential areas for improvements with recommendations for policymakers, educators, and other stakeholders on how to leverage the potential of ICT in higher education. Data was electronically collected through questionnaires administered by students and lecturers in selected higher educational institutions using convenient sampling method. ANOVA statistical technique wise employed for data analysis. Findings from the study revealed that a vast majority of the respondents believe that ICT makes provision for more dynamism with up-to-date learning contents and could improve the overall performance of students. Additionally, the study found that ICT adoption rate in Sierra Leone is weak largely because of lack of ICT knowledge and awareness and the high cost of necessary infrastructure. The paper recommends that due to high cost of technology, Government must support higher educational institutions in their acquisition and maintenance; Institutions should make them a matter of priority and budget for them; and the compulsory use of ICT in the classroom must be encouraged.

Keywords: Higher Educational Institutions, Lecturers, Students, ICT Infrastructure and E-learning.

1. Introduction

The revolution in Information and Communication Technologies (ICTs) is driving and enhancing every aspect of professions and businesses directly or indirectly. The additional aspect of the Internet in ICT has changed the state of play worldwide; it seems to have brought great impact on modern educational instructional tools. Sierra Leone is a country in West Africa that has faced significant challenges in its educational system over the years. The country has a relatively low literacy rate, with only 47.7% (<https://tradingeconomics.com>, 2023) of the population able to read and write. In recent years, the government of Sierra Leone has recognized the importance of education and has made significant efforts to improve the quality of and accessibility to education in the country. One of the ways in which the government has sought to improve education is through the integration of information and communication technology (ICT) in the teaching and learning aspects of the educational system. ICT has the potential to enhance teaching and learning processes, increase access to education, and improve student learning outcomes.

ICT has the potential to transform education in developing countries like Sierra Leone by providing access to educational resources that were previously unavailable or inaccessible. With the help of ICT, students can access educational materials, including textbooks, videos, and online courses, regardless of their location. Also, ICT has the potential to improve the quality of teaching and learning by facilitating interactive and personalized learning experiences. Additionally, ICT can help promote communication and collaboration among students and faculty, support administrative processes, and improve the overall efficiency of educational institutions.

Higher Educational Institutions in Sierra Leone to date, lack adequate equipment, infrastructure and quality electronic learning materials. ICT today has not yet become a catalyst for important change in Sierra Leone's education. Most of Sierra Leone's efforts so far to embrace ICT in education have proved futile. Sierra Leone faces significant challenges as it continues its program of economic and social development in the evolving ICT age. The new global economy requires that Sierra Leone develop an education system that promotes ICT. This approach will improve the impact of ICT on higher educational system and hence facilitate economic development.

The Ministry of Technical and Higher Education in Sierra Leone is supporting the e-learning systems initiative of the University of Sierra Leone and other higher educational institutions as a means of enhancing the quality of education and increasing access. In May 2009, the Government of Sierra Leone released the first version of the National ICT Policy, which was updated in 2017. The policy addressed the economic, social and political objectives of ICT. The

ICT infrastructure and Internet penetration were looked at. Questions to ask are, “Is this policy adequate”? Has it created any impact fourteen years on? Has it influenced tertiary education, positively?

To confirm the impact of ICT, a barometric measurement was used in terms of conducting a survey at the tertiary education level involving both lecturers and students. The survey was done by researchers from the Institute of Public Administration and Management – University of Sierra Leone. The Universities targeted include the University of Sierra Leone, the Njala University, the University of Makeni and the Eastern Technical University amongst others.

The objective of this paper is in two-folds. First, to examine the current state of ICT use and e-learning, especially as it relates to its impact on teaching and learning. Second, to identify potential areas for improvements with recommendations for policymakers, educators, and other stakeholders on how to leverage the potential of ICT in higher education in Sierra Leone.

2. Materials and Methods

ICTs have many definitions but the study would like to adopt the one given by World Innovation Technology and Services Alliance, (WITSA, 2006) which described it as “tools that facilitate communication and the processing and transmission of information and the sharing of knowledge by electronic means”. This definition considered the full range of electronic digital technologies such as radio, telephone, television, computers, and electronic media such as the Internet.

Overview of the Educational System in Sierra Leone - The organized documents for the educational sector are the 2004 Education Act and the 2010 National Education Policy, though they are currently under review. The existing Education Sector Plan sets four levels of education provision such as:

- Pre-primary education, consisting of three years of pre-school education;
- Primary education, lasting six years;
- Secondary education, which is divided into three years of compulsory junior secondary education i.e. the Basic Education Certificate Examination, three years of upper secondary education. Upper secondary education is either general education or TVET (technical and vocational education and training); and
- Tertiary education, including teacher education and courses offered by universities, polytechnics and professional colleges, generally taking two to four years.

Early childhood education and basic education is mandatory. The Constitution of Sierra Leone provides for “free compulsory basic education at primary and junior secondary school levels”

and “free senior secondary education as and when practicable” (Government of Sierra Leone, 1991). In 2018, the government launched ‘Free Quality School Education’, a five-year initiative that sets out to make pre-primary, primary and secondary education free of charge for all pupils studying at government-approved schools (Maada Bio, 2018). Overall responsibility for the education system is shared between the Ministry of Basic and Senior Secondary Education (MBSSE) and the Ministry of Technical and Higher Education. Significant agencies reporting to the MBSSE, include the Teaching Service Commission, which is tasked with improving teacher management and performance.

Sierra Leone has a long history of higher education. Fourah Bay College (FBC), founded by the Church Missionary Society (CMS) in 1827 as an institution for training clergy, is the oldest tertiary institution in West Africa. In 1867, it began awarding degrees, through its affiliation with the University of Durham in the United Kingdom. After independence in 1961, Njala University College (NUC) was established in 1964 with support from the United States Agency for International Development (USAID) to focus on agriculture and education programs. Similarly, tertiary level technical and vocational institutes were established. The higher and tertiary education (HTE) sector was a small but thriving sector that has been undergoing a process of restoration. Starting from 2001 to date, the following structures have been put in place - The Polytechnics Act of 2001 established polytechnic institutions by combining education colleges and technical vocational institutions and outlined their governance and institutional arrangement. The polytechnics were initially set up to grant post-secondary diploma and certificates awards. They included: the Eastern Polytechnic (EP)¹, the Milton Margai College of Education and Technology (MMCET)², and the Northern Polytechnic (NP)³. The National Council of Technical, Vocational and other Academic Awards (NCTVA) Act of 2001 established the NCTVA as a body to certify graduates at the diploma and certificate levels and to accredit such programs in tertiary institutions. The Tertiary Education Commission Act of 2001 (TEC 2001) established the Tertiary Education Commission (TEC) as the agency responsible for quality assurance of higher and tertiary education institutions. The University Act of 2005 reconstituted the University of Sierra Leone and the Njala University. This Act has been reviewed twice with the recent being 2021. The University of Sierra Leone comprise – the Fourah Bay College (FBC), College of Medicine and Allied Health Sciences (CoMAHS), and the Institute of Public Administration and Management (IPAM). The Njala University comprise - Njala University College, Bo Teachers College and School of Health Sciences, and Bonthe Technical Institute as an affiliate institution.

¹ Eastern Polytechnic (EP) now known as Eastern Technical University of Sierra Leone.

² Milton Margai College of Education and Technology (MMCET) now known as Milton Margai Technical University

³ Northern Polytechnic now known as Ernest Bai Koroma University

Information and Communication Technology and E-Learning - In these modern days, information and communication technology has led to many changes and development in various aspect of life, in particular the education sector. For instance, the growth of ICT has allowed higher education institutions to reach a wide range of students and improved student access to higher education. Scholkmann, (2017) stated that as a result of the developments in ICT and network technologies, further innovative distribution and learning methods have appeared in order to produce meaningful learning experiences for students in academic settings. Sierra Leone is among the developing countries where the usage of ICT and the use of e-learning is still in its embryonic stages (Gbamanja, 2018). The process of implementing the National ICT policy, specifically the development of projects in different domains in general is still on-going (Gbamanja, 2018). Although, the ICT departments of some tertiary institutions in Sierra Leone such as CoMAHS, FBC, UNIMTECH and Njala have some basic ICT infrastructure and facilities such as computers, projectors, network and Internet access, but they still rely heavily on the traditional education method of using face-to-face interaction in and out of the classrooms between students and teachers. However, as Sierra Leone is pushing hard to play a leadership role in West Africa, particularly in the period of pragmatic and competitive science and technology, there is an urgent need to give more prominent attention to the improvement of teaching and learning, particularly in Sierra Leone tertiary institutions. Information and Communication Technology (ICT) is an indispensable part of the contemporary world. In fact, culture and society have to be adjusted to meet the challenges of the information age. ICT is a force that has changed many aspects of peoples' ways of life. Considering such fields as medicine, tourism, travel, business, law, banking, engineering and architecture, the impact of ICT in the recent times has been enormous. The way the fields operate today is vastly different from the way they operated in the past. However, if one looks at the education sector especially Sierra Leone tertiary education system, there seems to have a little impact of ICT utilization and far less change, than other fields have experienced. Information and communication technology has the potential to accelerate, enrich and sharpen skills, motivate and engage students learning; helps to relate school experience to work practice; helps to create economic viability for tomorrow's workers; contributes to the total development of the institution; strengthens teaching and learning and provides opportunities for connection between the school and the world (Davis and Tearle, 2019). Information and communication technology is a tool for addressing challenges in teaching and learning, technology has the capabilities for delivery, management and support of effective teaching and learning. According to Yusuf, Afolabi, and Loto (2013), the use of ICT has fundamentally changed the practices and procedures of nearly all forms of endeavour within business, governance and civil service, and that in education ICT has begun to have a presence but the impact has not been as extensive as in other fields of endeavour. Adomi & Kpangban (2010) described ICT as electronic technologies used for information storage and

retrieval. According to the Online Oxford Dictionary, Information and communications technology or information and communication technology, usually abbreviated as ICT, is often used as an extended synonym for information technology (IT), but is usually a more general term that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers, middleware as well as necessary software, storage- and audio-visual systems, which enable users to create, access, store, transmit, and manipulate information. In other words, ICT consists of IT as well as telecommunication, broadcast media, all types of audios and video processing and transmission and network-based control and monitoring functions. The field of education has certainly been affected by the penetrating influence of ICT worldwide. It has made impact on the quality and quantity of teaching, learning and research in the institutions using it.

On the other hand, e-learning has become popular in higher education institutions in many countries (Anggrainingsih *et al.*, 2018; Basak *et al.*, 2016; Thai *et al.*, 2017; Muianga *et al.*, 2018). While the term “e-learning” has been thrown around quite a lot in recent years, many are still unaware of what it actually means and how it can help them achieve success in both their professional and personal lives. In essence, e-learning is a computer based educational tool or system that enables you to learn anywhere and at any time. E-learning is mostly delivered through the Internet, although in the past it was delivered using a blend of computer-based methods like CD-ROM. E-learning is also called Learning Management System (LMS). It offers the ability to share materials in all kinds of formats such as videos, slideshows, word document, and PDFs. Conducting webinars (live online classes) and communicating with professors via chat and message forums is also an option available to users. The idea of using and adopting e-learning has become widely accepted across higher education in many developed countries. Some developing countries also appear to adopt e-learning in their higher education to improve and enhance the education experience (Abdel-Gawad, & Woollard, 2015). Nevertheless, the adoption of this technology as a tool for teaching and learning in tertiary education in Sierra Leone is still in its infancy stage, where some of the difficulties and challenges are still being addressed. In fact, researchers found that the Critical Success Factors to adopt e-learning differ from one country to another due to reasons such as culture, policy, government regulation and economic environment. Most Sierra Leoneans are still quite tradition in their attitudes, customs, behaviours, communication patterns and protocols (Brima & Sesay, 2019). On the other hand, students as well as teachers are still generally unaware of the potential of e-learning in Sierra Leone. The introduction of the 2018 - 2020 Education Sector Plan (ESP) (Ministry of Education Science and Technology) in Sierra Leone has addressed the importance of sustainable learning with the aim of achieving knowledge-based economy. Many educational funds and subsidies were allocated by the government and private sectors to promote sustainable learning. According to Sawaneh and Sesay, (2022), World Bank Board of Executive Directors approved \$50 million

grant to support the Government of Sierra Leone's flagship program for Free Quality School Education launched in 2018. The Free Education Project supported some initial COVID-19 response activities, including provision of distance learning and communication campaigns on prevention and various financial supports from the private sectors. These financial supports were to encourage most of the higher education institutions in Sierra Leone to continue their educational and to further equip themselves with professional skills. However, this has not been actualized given the present state of the country's economy. The people in tertiary education shape the behaviour; minds and the social and human values of the student community. Effective use of technology can motivate students, make our classes more dynamic and interesting and renew teacher enthusiasm as they learn new skills and techniques, Rajouri & Jammu (2017). Universities in most developed countries and even in Africa are transitioning or have already moved, from face to face or traditional classroom learning, to blended education, and now to fully online learning offering the same courses and programs through a web-based system. Electronic learning or e-learning is used to offer instructional programs to distant learners (Arkorful and Abaidoo, 2015). It is an online learning platform that emerges in a formal context and utilizes a variety of multimedia technologies. Electronic hardware and software support this system either offline or online. A personal computer is usually used for delivering training or computer-enhanced learning related to e-learning (Samsuri, Nadzri and Rom, 2014). Other communication technologies deliver learning based on tutorials, learning support systems, and online lectures (Kattoua, Al-Lozi and Alrowwad, 2016). It is based on technology for improving classroom engagement through positive environment, where students are deliberately engaged in online tutorials for completing a task assigned to them.

Benefits of ICT and E-learning in Higher Education - Information and communication technology and e-learning have many advantages some of which are as follows: e-learning environments occur in an asynchronous mode, meaning that students have the opportunity to learn independently from anywhere at any time. From a learning perspective, one advantage of this mode of educational information delivery is that students can set learning to their own pace. In addition, e-learning modes of course delivery offer the student access to the internet through World Wide Web. This opens up the chance for students, who otherwise would be unable to attend a university, to gain a higher education by facilitating the busy schedules with which we are all encumbered. It also reduces university constraints due to limited classroom space and limited funding. During the COVID-19 pandemic, e-learning turned into an important alternative for reforming the entire traditional education system. Both teachers and students have had to change their behaviours, their teaching/learning style, assessment methods, and so forth. This reform has brought about several benefits, but has caused tensions and frustrations among both the beneficiaries of the teaching act and the educational actors. E-learning has shown that it is necessary to model the behaviours of all parties involved. In order to streamline the educational

process, especially the one carried out in the university environment, creative and constructive interventions are required. These would solve specific problems and could lead to ensuring the sustainability of education. Naveed et al. (2017), argue that, unlike face to-face learning, e-learning has its advantages, such as flexibility, no need to travel to school, and a low cost, requiring only an Internet connection. E-learning ensures that students are completely involved as learning takes place together with texts, videos, sounds, collaborative sharing, and interactive graphics. It may enhance the quality of teaching and learning, report the need for higher institutions for maintaining competitive advantage, and access to education and training in this globalizing marketplace for students (Islam, Beer and Slack, 2015). The integration of information technology (IT) in the form of e-learning has resulted in the reduction of students cost while improving the quality of learning and teaching (Songkram, 2015). This shows that e-learning can be economical for students using it, and they can perform other useful activities in their spare time (Aparicio, Bacao and Oliveira, 2016). Flexibility is another major advantage of e-learning as it provides learners the benefit to take classes anywhere and anytime. Furthermore, e-learning cater different types and varieties of learning approaches by utilizing much interactive content available on the internet (Songkram et al., 2015). Distance learning is an increasingly expanding environment, which enable users the flexibility to operate outside the barriers of place and time. In university education, online learning is explained as learning that takes place completely or partially over the Internet (Gilbert, 2015). The implementation of e-learning in education has been favourable in multiple contexts. Previous studies, have presented several advantages associated by the implementation of e-learning technologies into university education (Raspopovic et al., 2017). E-learning has been viewed as the ability to focus on the requirements of individual learners. For instance, focusing on the needs of individual learners can deliver knowledge in digital age effectively as compared to educational institutions' needs or instructors (Huang and Chiu, 2015). Objectives can be achieved in the shortest time with least efforts through e-learning. When managing the e-learning environment, its effects on educational learning are observed in providing equal access to the information regardless of the users' locations, their ethnic origins, races, and ages. We are in the world of technological development, functional and qualitative education, which are viewed as a necessary condition for national qualitative education, as a necessary condition for national development that cannot be achieved without sound knowledge of Information and Communication Technology (ICT). Gbadamosi (2016) identifies ICT as a factor that promote quality in higher education. Moreover, communication is a fundamental act of the education process. Therefore, to enhance quality, attention must be given to ICT. Indeed, the impact of Information and Communication Technology is becoming more and more pronounced worldwide such that rarely is anything mentioned in any area of human endeavour without reference to this technology. Information and Communication Technology is a force that has changed many aspects of the way people live.

Information is a key resource for undergraduate teaching, learning, research, and publishing. This brings the need for effective methods of information processing and transmission (Nwosu & Ogbomo, 2012). This has paved way for change not only the way society assesses knowledge but also transform and restructure traditional models of tertiary education. Information technology is one skill area that is now essential for young people to gain a foot hold in the labour market in developed and increasingly in developing countries (Laura & Brown, 2015). Presently, higher institutions of learning have been focusing on e-learning environment and much less on traditional methods as a result of the newly acquired capacity for students and teachers to have access to the internet any point in time. ICT also help teachers and students become actively engaged together in online collaborative work to enhance traditional learning methods (Oliver, 2011). ICT tools have helped people find, explore, analysed, exchange, and present information most importantly, without discrimination. When efficiently use, ICT can provide quick access to ideas and experiences from a wide range of people, communities and cultures (Kwame, 2010). ICT involves the development of effective and integrated tools as well as training modules to enable ICT application through effective teaching and learning. Promotion of better-quality research is made possible through ICT. Application of ICT are particularly powerful and uncontroversial in higher education's research function. The steady increases in bandwidth and competing power available have made it possible to conduct complex calculations on large data sets. Another important measurement of ICTs in research is the use of online full text data bases and online libraries/virtual libraries which are the direct outcome of the growth in telecommunications networks and technology. These databases and libraries provide researchers with online access to the contents of hundreds of thousands of books from major publishing houses, research reports and peer reviewed articles in electronic journals. Examples include: the Questa online library which provide access 24/7 to the world's largest online collection of books and journals in the Humanities and Social Sciences. E-registration of courses and details of examination and other services are being offered online, thereby, reducing pressure during course registration. With the use of ICT, students pay school fees online and check their results after every examination. Moreover, the use of the Internet could reduce administrative cost because the same information can be sent to all Departments through the Internet without having to do it individually. Therefore, communication both within and outside the department is a lot easier with the use of the Internet.

Challenges of Implementing E-learning in Tertiary Educational System - Though e-learning is very much key in today's education system in tertiary institutions, yet there are numerous challenges faced in its implementation and effectiveness in the tertiary education system. According to Nwankwo (2013), the obstacles for ICT implementation include: insufficient number of computers, teachers' lack of ICT knowledge/skills, difficulty to integrate ICT to instruction, scheduling computer time, insufficient peripherals, inadequate copies of software,

insufficient teacher time, not enough simultaneous access, not enough supervision staff and lack of technical assistance. Other common problems associated with the effective implementation of ICT are lack of qualified ICT personnel, cost of equipment, management attitudes, inconsistent electric power supply, inadequate telephone lines, particularly in the rural areas and non-inclusion of ICT programmes in teachers' training curricula and at the basic levels of education. Nwankwo (2013), summarizes these challenges as limited equipment, inadequate skills, minimal support, time constraints and teacher's own lack of interest or knowledge about computer. The University of Sierra Leone being the oldest tertiary institution in the country has three major institutions, namely - Fourah Bay College (FBC), Institute of Public Administration and Management (IPAM) and the College of Medicine and Allied Health Sciences (CoMAHS). Currently, the university hosts a single website and from which the three institutions are linked with essential resources. The website lacks integrated facilities to allow integrated learning resources for the enhancement of flexible learning in the 21st century. IPAM as a dedicated ICT-based delivery institution has some capacity to support students learning through flexible provision, but this is also restricted as financial resources required to forge such progress is restricted. Recently in 2023, under the University of Sierra Leone, IPAM has established and launched e-learning centres in Bo and Makeni, Southern and Northern regions of Sierra Leone. There is still a long way to go, particularly for constituent institutions to keep pace with the integration of technology in their curriculum provision, which in a similar not as already mentioned, is due to lack of adequate financial resources to create relevant investments to support the delivery of technology mediated facilities, Jackson (2016). Challenges is an obvious concern when thinking about implementing technology mediated system in an institutional setting. In developing countries, particularly in a country like Sierra Leone, the challenges are enormous, considering the bitter experiences the country has witnessed in the past decade or two; the civil war which left the country in destruct ionof infrastructural base to support the delivery of an effective technology-mediated system, and in 2014, the impact of the killer Ebola epidemic that left the country cash-strapped of delivering essential services like educating the future generation. The current systems' network support and cost, particularly for publicly funded educational institutions pose serious challenges, as tertiary institutions are really not in the right state to set themselves in a competitive state of (flexible) educational provision when compared to their English-speaking West African counterparts like Nigeria and Ghana. The lack of basic ICT infrastructure and inadequate manpower skills is also a challenge facing tertiary institutions in Sierra Leone. Computer-based courses are delivered in most tertiary institutions in Sierra Leone, but the present state of systems seemed quite slow and old to support current requirements to build an effective integrated technology provision for tertiary institutions in the country. The major problem is attributed to the lack of adequate planning in terms of meeting current rise in students' population, and also assessing needs requirements to support effective

teaching and learning (DFID, 2014). Institutions lack the necessary manpower skills-base to support continuity in ICT service provision; this in part may be attributed to the low investment capacity of the government in focusing attention to technology investment for educational institutions in the country. Despite of the significant advantages of e-learning, students encounter several challenges which ultimately lead towards either limited or negative outcomes. Such as Arkorful and Abaidoo (2015) in their study outlined that e-learning, in certain cases is held through remoteness and contemplation resulting in lack of student's interaction. In comparison with the contemporary mode of education, e-learning might result in being less effective due to the absence of face-to-face encounter with instructions or teachers. Since in e-learning method, assessments are generally held online which reduces the possibility of restricting illegitimate activities such as; cheating, plagiarism etc (Arkorful and Abaidoo, 2015). The absence of essential personal interactions is the most noticeable drawback of e-learning, not only among colleague learners, but also between instructors and learners (Islam, Beer and Slack, 2015). There is a scarcity of community in the online learning environment as student-student engagement is much less of a concern when compared with student-instructor interaction. Gilbert (2015) highlighted that most of the students wish to work autonomously to avoid the need to interact with their classmates. Technology is a platform that can be easily acquired for granted when it is engaged into daily life, but it is not widely used because of the lack of monetary benefits for achieving access. The global knowledge available on the Internet is led by increasing the proportion of computers and other electronic devices to students (Talebian, Mohammadi and Rezvanfar, 2014). Another disadvantage is maintaining motivation in an online course that online learners experience. Students who lack self-motivation and independence had reduced success rates as compared to their counterparts (Sarkar, 2012).

The Blended Approach in the Tertiary Educational System - The blended approach consists of both the e-learning approach system and that of the traditional classroom approach system of learning. E-learning environments occur in an asynchronous mode, meaning that students have the opportunity to learn independently from anywhere at any time. From a learning perspective, one advantage of this mode of educational information delivery is that students can set learning to their own pace. Furthermore, e-learning environments transcend the need for the "real" classroom, allowing the student to operate in a virtual reality. Traditional classroom teaching focuses on a number of elements including lecture, case studies, team projects, and so forth. Learning is conducted in a synchronous environment, meaning that the students must be in the same place at the same time in order to learn. The traditional classroom has the major advantage of face-to-face interaction between the student and educator as well as between the students themselves. Students derive motivation from the teacher as well as from the other students. In this environment, "learning is enhanced when it is more like a team effort than a solo race. Thus, learning occurs in both synchronous and asynchronous modes. In the blended approach courses,

it is up to the teacher to determine what aspects of the course are best suited for presentation via the various delivery modes. In the ideal, blended approach courses offer educators the best of both worlds. E-learning material is viewed as an extension of the classroom, and traditional lectures may be linked with virtual tours of organizations being studied. Students receive the benefit of face-to-face interaction with faculty and students while at the same time being exposed to web-based learning paradigms such as virtual real-time information, maps, pictures, streaming video and audio clips. Blended approaches may also extend to providing students with both "real" office hours and "virtual" office hours, working in both face-to-face teams and virtual teams, and so forth. The key to successful blended approach system is to analyze course material, determine how well existing material will translate online, creating new approaches to communicating with students, and evaluating and rebuilding the course as problems arise. The emergence of ICT, and more recently flexible learning resources and platforms has made it very much possible for a mix of learning style to be made possible; this is based on the concept of blended learning (University of the Free State, n/d: 5; Jackson, 2015b), an approach incorporating variety of learning approaches, for example, face-to-face / didactic learning and the use of ICT to enhance learning opportunities for learners. An effective way of delivering e-learning can be to complement it with face to-face (F2F) training within the same learning programme. This approach is generally called 'blended learning approach system. Blended courses can be defined as a combination of face-to-face with online experiences, to produce effective, efficient and flexible learning (Stein and Graham, 2014). In order for the blended learning approach system to be more effective, the following are some of the ways in which it can be used:

Using e-learning before a face-to-face event: An online pre-class event can be used to level the knowledge and skills of learners before the face-to-face class begins. For example, the online event can be an assignment. The trainer may review the results of the online session and adjust the programme for the face-to-face class by focusing on knowledge and skills gaps. Alternatively, the online event can include readings and online discussions. It is important that everyone does the preparatory reading in order to make a meaningful contribution to the online discussion. From the discussion, the trainer can recognize the critical areas for the face-to-face session. The face-to-face event is much more effective than it might have been, because the participants have come to class with ideas and opinions about the topic (Stein and Graham, 2014). To optimize efforts to design and produce e-learning courses, the materials designed for e-learning – including media elements such as videos and infographics, together with textual content – can be reused to create training materials for face-to-face sessions.

Another way for the blended learning approach to be more effective is using e-learning as follow-up to a face-to-face event; this approach consists of starting with a core classroom event,

followed by online independent experiences that can include, for example, interaction with online resources or e-mentoring services for continuous reinforcement. This approach could be used to develop communities of learners or to engage in further discussions on advanced topics of individual interest.

2.1 Research Methodology

This survey was conducted over a 2-week period nationwide, in regions with tertiary educational institutions in 2023. Two (2) questionnaires were developed based on previous work done on the subject area. These questionnaires seek to sought both lecturers' and students' perceptions on the subject area and it comprised two categories of questions and statements. The questions were open and close-ended. The questionnaires contained 42 and 27 item questions for students and lecturers respectively divided into three sections - A, B and C. The first section (i.e. Section A) had 11 and 7 questions bothering on personal details of the respondents; followed by Section B which had 25 and 13 questions relating to information about respondents' computer literacy and the use of computer applications and Section C had 6 and 6 open-ended questions on students' and lecturers' perceptions respectively on the impacts of ICT on higher educational system in Sierra Leone. In all, there were 6 and 6 unstructured/open ended questions and 36 and 21 structured/close ended questions for both students' and lecturers' perceptions respectively.

The questionnaires were electronically self-administered through google form by students and lecturers as respondents from prominent tertiary educational institutions in the country. This sampling method was done because it is considered as the most cost effective, efficient and less time to administer. The links to the questionnaires were sent out to mostly lecturers who subsequently were required to send the student link to their students to participate. These respondents were targeted from the University of Sierra in the western region, the Njala University from the southern region, the Eastern Technical University from the eastern region and the Makeni University in the northern region. The selected respondents were those who successfully completed the questionnaire online.

3. Findings and Discussions

Demographic Characteristics

Data were obtained from 186 and 128 student and lecturer respondents respectively. The demographic factors revealed that there were more female (53.8%) and male (46.2%) for student respondents while for lecturer respondents, majority (87.5%) were male while 12.5% were female. This indicates that there are more male academic staff than female in Sierra Leone tertiary educational institutions during the period of study. The analysis revealed that 49.5% of student respondents were between 21 – 25 years, 21.5% were between 16 - 20 years, this could

be as a result that these categories are young and are more technologically inclined while 18.8% each of the lecturer respondents fall between the ages 31 – 35 years and 41 – 45 years respectively. A greater proportion of respondents are therefore young for both the student and lecturer respondents and are likely individuals who are readily willing to provide useful information on the subject matter of the research. The views of the few respondents above 50 years old were also taken into consideration thus making the study present a fair and balance report on ICT impact on the higher educational system in Sierra Leone.

The survey revealed that 56.3% of the lecturer respondents are full-time staff while 82.8% are also full-time students. 62.3% of the lecturer respondents are from the University of Sierra Leone, 12.6% from Njala University, 18.8% are from the Eastern Technical University while 6.3% are from the University of Makeni. For the student respondents, 89.2% were from the University of Sierra Leone 5.4% from Njala University, 3.2% from the University of Makeni and 2.2% from the Eastern Technical University. Majority (71.0%) of the student respondents were in Year 1 of the different courses while 25.0% of the targeted lecturer respondents teach all levels – diploma, undergraduate and graduate courses. The questionnaire enquired the lecturers' years of experience, 31.3% of the lecturers have been in the profession from 7 to 10 years, 25.0% for 11 to 15 years, 18.8% each for 4 to 6 years and over 20 years respectively. This shows that majority of the respondents are seasoned and well conversant with the operations of their institutions and academic field.

Also revealed, 25.0% each of the lecturer respondents fall under procurement and social sciences disciplines, 18.0% under finance and accounting, 12.5% each fall under arts and business administration, only (6.3%) of the respondents are specialists in information systems/technology; this shows that, there is inadequate ICT specialists in the tertiary institutions of Sierra Leone. While for the student respondents, 66.7% fall under business administration discipline, 9.7% fall under procurement, 3.2% under social sciences only 1.1% each fall under medicine and information systems and technology.

Table 1.0: Regression equation results (ANOVA): Disaggregated Information Communication and Technology Impact

Impact of Information Communication and Technology										
ICT indicators	Personal Information							Education		
	Age	Sex	University	Level	Part/full	Mode of class	Specialization	Knowledge	methods	Learning
ICT Information Systems offered as a module	-1.456 ^{***}	0.085	-0.804	1.160 ^{***}	-0.039	1.003 ^{***}	1.982 ^{**}	0.046	0.348	3.960
	(0.462)	(0.154)	(0.997)	(0.270)	(0.142)	(0.045)	(0.807)	(0.041)	(0.623)	(4.532)
	[-3.152]	[0.551]	[-0.807]	[4.293]	[-0.275]	[22.430]	[2.456]	[1.126]	[0.558]	[0.874]
Session(s) or contact hours per week	0.044	-0.47	0.995	0.066	-0.009	0.039 ^{**}	-0.001	0.036	-0.061	-0.150
	(0.190)	(0.064)	(0.997)	(0.111)	(0.058)	(0.018)	(0.324)	(0.017)	(0.256)	(0.241)
	[0.234]	[-0.746]	[-0.807]	[0.598]	[-0.155]	[2.101]	[-0.002]	[2.136]	[-0.238]	[-0.622]
Practical exercises / sessions as a component of the module	-1.172 ^{***}	0.133	-1.241	0.552 ^{***}	-0.178 [*]	0.530 ^{***}	0.153	-0.014	-0.003	2.170
	(0.300)	(0.100)	(0.647)	(0.175)	(0.092)	(0.029)	(0.521)	(0.027)	(0.404)	(2.189)
	[-3.906]	[1.326]	[-1.918]	[3.146]	[-1.935]	[18.242]	[0.295]	[-0.528]	[-0.008]	[0.992]
Rate of Practical exercises offered	-0.073	0.175 [*]	-0.142	0.314 [*]	-0.011	-0.005	-0.362	-0.018	0.488	0.601 [*]
	(0.292)	(0.098)	(0.631)	(0.171)	(0.090)	(0.028)	(0.499)	(0.026)	(0.394)	(0.351)
	[-0.249]	[1.787]	[-0.226]	[1.834]	[-0.125]	[-0.165]	[-0.726]	[-0.693]	[1.239]	[1.711]
Access to computers aside contact hours at the university	-0.633	-0.219	0.108	0.039	-0.207	0.305 ^{***}	0.557	0.580	-0.206	.426
	(0.425)	(0.142)	(0.918)	(0.249)	(0.130)	(0.041)	(0.729)	(0.038)	(0.573)	(1.140)

	[-1.487]	[-1.542]	[0.118]	[0.159]	[-1.584]	[7.410]	[0.764]	[15.291]	[-0.360]	[0.373]
	-0.190	-0.140	-0.663	0.029	0.129	0.008	0.018	0.196***	-0.677	-0.390
Rate of access to computer	(0.309)	(0.103)	(0.667)	(0.181)	(0.095)	(0.030)	(0.527)	(0.028)	(0.417)	(0.519)
	[-0.615]	[-1.359]	[-0.995]	[0.161]	[1.364]	[0.258]	[0.033]	[7.116]	-1.624	[-0.751]
	-1.039*	0.387**	0.178	-1.219***	0.296*	-0.210***	-1.118	-0.142***	-1.955**	-1.999**
Ownership of computer	(0.560)	(0.187)	(1.208)	(0.328)	(0.172)	(0.054)	(0.957)	(0.050)	(0.755)	(0.839)
	[-1.856]	[2.064]	[0.147]	[-3.721]	[1.725]	[-3.865]	[-1.167]	[-2.851]	[-.589]	[-2.384]
	0.411	-0.051	0.379	-0.348*	0.086	-0.030	-0.247	-0.011	0.138	0.054
Rate of access to own computer	(0.347)	(0.116)	(0.749)	(0.203)	(0.106)	(0.034)	(0.592)	(0.031)	(0.468)	(0.424)
	[-1.185]	[-0.438]	[0.506]	[1.716]	[0.807]	[-0.894]	[-0.417]	[-0.348]	[0.294]	[0.128]
	-0.009	0.131	-0.315	0.024	0.003	-0.031	-0.380	-0.013	-0.568	-0.790*
Comfortability to do work with a computer	(0.332)	(0.111)	(0.716)	(0.194)	(0.102)	(0.032)	(0.566)	(0.031)	(0.448)	(0.414)
	[-0.028]	[1.185]	[-0.440]	[0.122]	[0.027]	[-0.958]	[-0.672]	[-0.450]	[-1.270]	[-1.906]
	-0.106	-0.176	0.087	0.151	0.043	-0.022	0.906	-0.043	-1.258**	-0.894
Internet usage	(0.425)	(0.145)	(0.938)	(0.254)	(0.133)	(0.042)	(0.743)	(.039)	(0.593)	(0.572)
	[-0.243]	[-0.125]	[0.093]	[0.593]	[0.323]	[-0.531]	[-1.219]	[-1.120]	[-2.123]	[-1.563]

	-0.010	0.026	0.010	-0.013	-0.067	0.021	-0.007	0.011	0.169	-0.011
	(0.167)	(0.056)	(0.360)	(0.098)	(0.051)	(0.016)	(0.285)	(0.015)	(0.233)	(0.224)
	[-0.060]	[0.464]	[0.029]	[-0.128]	[-1.312]	[1.292]	[-0.025]	[0.733]	[0.725]	[-0.050]
	-0.292	-0.198	-0.955	0.038	0.043	0.032	-0.288	.065	-0.877	
	(0.412)	(0.138)	(0.888)	(0.241)	(0.126)	(0.040)	(0.702)	(0.037)	(0.555)	-
	[-0.710]	[-1.438]	[-1.075]	[0.159]	[0.340]	[0.801]	[-0.411]	[1.779]	[-1.581]	
	0.237	-0.053	0.170	0.455	-0.083	0.014	-0.002	0.013	-0.214	0.202
	(0.251)	(0.084)	(0.542)	(0.147)	(0.077)	(0.024)	(0.429)	(0.022)	(0.339)	(0.306)
	[0.941]	[-0.625]	[0.313]	[3.093]	[-1.070]	[0.591]	[-0.005]	[0.559]	[-0.632]	[0.661]
	8.180***	1.263***	3.626	1.085	1.195	0.166	0.7994***	0.064	8.469***	-1.074
	(1.123)	(0.376)	(2.422)	(0.657)	(0.344)	(0.109)	(1.916)	(0.100)	(1.513)	(8.271)
	[7.283]	[3.362]	[1.497]	[1.651]	[3.471]	[1.528]	[4.173]	[0.637]	[5.597]	[-0.130]
No. Of Observation	109									
R - Squared	0.499	0.101	0.006	0.570	0.116	0.963	-0.016	0.930	0.123	0.038
F - statistic	9.266***	1.934**	1.050	12.010***	2.093**	217.416***	0.871	112.061***	2.155**	1.302

Source: Developed by the Researcher, 2023. Legend: Values $P < 0.01$ ***; $P < 0.05$ ** and $P < 0.1$ * Standard error () and t – value

Results from Table 1.0 provides analyses on the impact of ICT on personal characteristics of respondents (Students and Lecturers) and on education. The impact that students offering ICT as a module, the number of ICT sessions and contact hours on weekly basis, how practical exercises held and access to own computer will have on the respondents is limited to some of their personal information and not on education. Conversely, comfortability to work with a computer and internet usage only impacted few aspects of education.

Specifically, the impact of ICT offered as a module on the personal information of respondents show mixed results. The coefficient and probability values of ICT information systems on age, level of education, mode of taking classes and specialization is -1.456 (statistically significant at 1%), 1.160 (statistically significant at 1%), 1.003 (statistically significant at 1%) and 1.982 (statistically significant at 1%) respectively. The number of sessions or contact hours per week of students' coefficient on mode of class is 0.039 and statistically significant at 5% level.

Practical exercises / sessions as a component of the module coefficients and statistically significant figures are -1.172 (1%), 0.552 (1%), -0.178 (10%), 0.530 (1%) for age, level of education, part/full time and mode of class respectively. Rate of practical exercises offered impact on age, level of education and learning coefficient and probability values are 0.175 (10%), 0.314 (10%) and 0.601 (10%) respectively. Also, access to computers aside contact hours at the university ICT indicator impact on knowledge has a coefficient and probability of 0.196 and 1% respectively.

Ownership of computer has impact on age, sex, level of education, mode of classes, specialization, knowledge, method and learning. Its coefficient and probability values are -1.039 (10%), 0.387 (5%), -1.219 (1%), 0.296 (10%), -0.210 (1%), -0.142 (1%), -1.955 (5%) and -1.999 (5%) respectively. Also, rate of access to own computer has a coefficient of -0.348 and statistically significant at 10% and comfortability to do work with a computer has a coefficient of -0.790 and statistically significant at 10%. The impact of Internet usage on the method of learning is depicted by a coefficient of -1.258 and statistically significant level of 5%.

ICT Impact on Personal Information: With the exception of the university students and lecturers belong and whether they are part time or full timers, ICT offered as a module by students have effects on their personal information. That is, it has positive impact on the level of education (year one, two...), e-learning and their field of study, but negatively on their ages. What this signifies is that, the more ICT related modules students offered, the easier it will be for them to go through their courses (from year one, two ...). Part time students that offered ICT modules and take their classes via e-learning mode benefit more from ICT than their counterparts. Furthermore, such benefit will be immense with students who offered more sessions or contact hours per week in learning these modules. The benefit of offering ICT as a

module by students will be greater if the field of study of students entails higher than lower level of research. Contrarily, younger students that offered ICT as a module are negatively impacted by ICT. Maybe because, they tend to use it for purposes that do not make economic sense or wisely.

The practical exercises or sessions that students are exposed to as a component of the ICT module has similar impact on students, as students that offered ICT as a module. In addition, the result also shows that, the offering of more practical sessions has diminishing effect on part time students, as they are constrained with time. Furthermore, if practical exercises/sessions are rolled out very often, it will have a positive impact on male rather than female students. This may be due to the fact that the practical sessions do not take into account gender differences as such, female students become disinterested and boycott such sessions. Also, students especially those that are in their third or final year never attend such practical sessions. This may be due to practical sessions not required for final year students or they are concerned more on writing their dissertations rather than practising ICT and getting access to computer outside the university is only beneficial to part time students.

Ownership of computer has a positive impact on gender and part time students and lecturers. This means that there are more male students and lecturers that own computer than female and these students and lecturers are mostly part timers. Computer ownership by students and lecturers negatively impact their ages, level of education, mode of class and specialization. That is, older and higher-level students and lecturers are those that own computer as opposed to younger and lower-level students and lecturers and also, students and lecturers that engage in e-learning mode and offering humanity courses. However, lower-level students and lecturers tend to have more rate of access to computer than older students and lecturers.

ICT Impact on Education: The result from regression specification suggests a positive impact of ICT on the rate of practical exercises offered on learning. That is, the higher the number of practical exercises offered by students, the easier they are able to learn and personalize their learning and speeds up e-learning processes. Similarly, the knowledge that students will acquire from ICT usage is also explained by the rate of access students have with their computer. Specifically, the more access students get with their computers the more they are able to not only know about their discipline but also extend it to other fields of study and as such, increase their knowledge beyond international borders.

The ownership of computer by student's and lecturer's indicator has negative impact on all education variables. To start with, students and lecturers that own computers have little knowledge on other subject matters and decreased learning. This may suggest that they do not even know how to effectively operate the computers or they are using them for other non-useful

purposes which stifle their ability to acquire knowledge in that respect and as such reduces learning. Again, the negative impact of ICT on students and lecturers in e-learning mode is explained by them having computers and working with them comfortably, but engage in the traditional mode of teaching - black board and chalk.

Finally, students and lecturers that very often use the internet use it for e-learning purposes. That is, the use of internet is very beneficial to the successful rolling out of the e-learning mode of teaching and learning.

4. Conclusions and Recommendations

ICT should no doubt contribute significantly to effective teaching and learning in higher educational institutions however, the huge financial cost of IT infrastructure, inadequate infrastructure and poor technical knowhow have hampered the expected outcomes lecturers and students are to benefit from the use and application of ICT. For those who make use of them, it is limited and financial resources are not readily available to put such infrastructure in place. The use of ICT and e-learning are still not very common and popular in most of the developing country like Sierra Leone because of the prohibitive cost to purchase its equipment and installation; lack of manpower and inadequate ICT training facilities. These factors have constituted as a serious challenge to the development of ICT in the educational institutions. countries. The following recommendations are therefore made to address this problem of poor development in ICT teaching and learning activities and policy decisions that need to be made by policy makers and other stakeholders in the education sector:

- Due to high cost of technological infrastructure in Sierra Leone, Government must support higher educational institutions in their acquisition and maintenance. The Government of Sierra Leone must invest and subsidise the provision of technological infrastructure and regular and efficient Internet facility in all higher educational institutions. Educational institutions should make them a matter of priority and budget for them;
- Necessary action must be taken to address the prohibitive cost of Internet use by making average charges affordable to students and lecturers of higher educational institutions in order to enable users enjoy maximum use of the services. Telecommunication companies can come to the aid of higher education institution by providing reasonable and affordable prices as part of their corporate social responsibilities to the education sector and the society;
- Government should mandate the development of ICT policy and strategic plans at institutional level;

- Government should review the national ICT policy document to mandate the teaching and use of ICT not only in higher educational institution but even at primary and secondary levels, if possible;
- Government and ministries in charge should embark on making provision for adequate and up to date teaching and learning materials especially the computers, ICT tools and computer aided learning for both the lecturers and students as this process will help students to get more attracted to ICT as a discipline in schools and universities with the aim to make e-learning effective and efficient;
- One student to one computer ratio must be implemented in all the universities, hence, government should support the universities with the necessary financial resources or fund to promote e-learning system in the tertiary institutions;
- Educational institutions should make the use of ICT in the classroom compulsory and must be encouraged as part of the teaching and learning methodology. Capacity building: develop training programs to enhance the ICT skills of educators, administrators and support staff, and as well, encourage continuous professional development and provide resources for learning new technologies and pedagogical approaches.
- In recruiting new lecturers, computer literacy must be one of the prerequisite criteria; this will increase the number of lecturers with technical knowhow in order to promote ICT in the teaching methods;
- Research and innovation: tertiary institutions should encourage research and innovation among faculty members and students by providing incentives for individuals who develop new technological innovation and research; and
- Universities must embark on new curricula development and collaboration with IT related industries and international organisations to jointly develop IT related curricula that meet international standards.

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