# INFORMATION AND COMMUNICATION TECHNOLOGY ENVIRONMENT FOR LEARNING AND DEVELOPMENT OF STUDENTS' DIGITAL LITERACY SKILLS IN SELECTED TANZANIAN UNIVERSITIES

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## DECLARATION

I declare that this thesis is my original work and has not been presented in any other university/institution for consideration. The thesis has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited in accordance with anti-plagiarism regulations.

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## DEDICATION

To my wife Plasida, my sons Nevin and Nashon and my one and only daughter, Ivy

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## TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## ABBREVIATIONS AND ACCRONYMS

| | |
|---|---|
| AAU | Association of African Universities |
| ADSI | African Digital School Initiative |
| AUC | Africa Union Commission |
| CESA | Continental Education Strategy for Africa |
| CICT | Center for Information and Communication Technology |
| CLL | Changing Learning Landscape |
| CSTD | Commission on Science and Technology Development |
| CVL | Center for Virtual Learning |
| DLSs | Digital Literacy Skills |
| DLF | Digital Literacy Framework |
| EFA | Education for All |
| EMIS | Education Management Information System |
| ESDP | Education Sector Development Programme |
| EUA | European University Association |
| EUC | European Union Commission |
| ICT | Information and Communication Technology |
| LMS | Learning Management System |
| MCT | Ministry of Communication and Transportation |
| MDGs | Millennium's Development Goals |
| MoEST | Ministry of Education, Science and Technology |
| MoEVT | Ministry of Education and Vocational Training |
| MoFP | Ministry of Finance and Planning |
| MOOCs | Massive Open Online Courses |

| | |
|---|---|
| MoWTC | Ministry of Works, Transport and Communication |
| NEPAD | New Partnership for Africa's Development |
| NICTBB | National ICT Broadband Backbone |
| NRENs | Research and Education Networks |
| OECD | Organisation of Economic Co-operation and Development |
| OERs | Open Education Resources |
| SSA | Sub Sahara Africa |
| SEACOM | Southern and Eastern Africa Communication Network |
| SGDs | Sustainable Development Goals |
| SNs | Social Networks |
| SLIDA | Supporting Learning in Digital Age |
| SPSS | Statistical Package for Social Sciences |
| STHEP | Science and Technology Higher Education Project |
| SUA | Sokoine University of Agriculture |
| UDSM | University of Dar es Salaam |
| UNESCO-IS | UN Educational, Scientific and Cultural Organization-Institute of Statistics |
| URT | United Republic of Tanzania |

## ABSTRACT

This thesis explores the influence of ICT environment for learning on level of digital literacy skills for learning among undergraduate students of the selected Universities in the United Republic of Tanzania. Specifically, the study examines the trends of students' digital literacy skills for learning; classroom support for students' acquisition of digital literacy skills; adequacy of basic ICT infrastructure to support students' digital literacy skills and; influence of students' prior ICT background on digital literacy skills for learning. The study was guided by Situated Learning Theory by Lave and Wenger (1991) because its tenets provide guidelines for setting up appropriate learning environment. The study employed a Qualitative Case Design to compare two holistic (university) cases (University of Dar es Salaam-UDSM and Sokoine University of Agriculture-SUA). The cases were selected due to their history, size, and evidence for potential ICT activities in the country and therefore the multiplier effects. A multi-stage sampling technique was used to pick students across years and programs of study. Further, purposive sampling technique was used to pick other actors namely, instructors, coordinators of E-learning at practical level and Deputy Vice Chancellors (academic affairs) at the management level. Multiple methods of data collection, namely; questionnaires, in-depth interviews, FGDs, observation were used to collect primary data and documentary review for secondary data. In the end, the study employed a multiple methods of data analysis (descriptive, thematic, impressionist and content analysis). Excel and SPSS computer programs were used to support the analysis process. The study found that, majority of students in the selected universities encountered difficulties to learn with ICTs because of limited Digital Literacy Skills (DLSs). Universities are constrained by inadequate ICT infrastructure; however, such inadequacy is exaggerated. The ICT infrastructure which would otherwise support training students to learn with ICTs are underutilized and have not realized the appropriate use due to users' mindset. Certainly, this delays students' mastery desirable skills to use the ICTs in place. Instructors confirmed their unpreparedness to support students' skills to learn with ICTs, and to them, digital literacy skills for learning was uncommon. Although majority of students seems to have some prior theoretical ICT backgrounds, that do not make them adapt comfortably to the learning practices in universities because of gaps in terms of technology and pedagogies between primary and secondary levels on one hand, and university on the other. The major conclusion of this study is that, universities are challenged to ensure a set-up of ICT environment for learning in which ICT infrastructure and its use for routine teaching and learning focus on enabling students to learn with the ICTs. Therefore, the study recommends a need for ministries responsible for Education and universities to prioritise coordinated arrangements to promote DLSs of students, build the capacity of instructors to support their teaching roles and DLSs among students in line with the UNESCO's Digital Literacy Framework.

# CHAPTER ONE

# INTRODUCTION AND BACKGROUND TO THE STUDY

## 1.0 Introduction

This chapter presents a background to the study, which covers global, regional, and Tanzania's ICT initiatives and state of an ICT environment, ICT use and digital literacy for learning in universities. Other components include problem statement, study objectives and questions, significance of the study, limitations and delimitation of the study, basic assumptions, theoretical and conceptual frameworks and the operational definitions of terms.

## 1.1 Background to the study

The global trends forcing the adoption of Information and Communication Technology (ICT) in education have both long and short term scope. Based on Becker et al. (2018) and the Organisation for Economic Co-operation and Development-OECD (2018), the long term drivers relate to; a desire to advance the culture of innovation and; a cross-institutional and cross-sector collaboration and partnership. With the growing culture of innovation, Higher Education Institutions (HEIs) must assess their curricular and implement changes to their evaluation methods and remove barriers that limit the development of new ideas. The emerging cross-institutional and sector partnership means that universities with financial constraints can pool and share digital resources and opportunities for both learners and instructors (like course e-materials, data and ICT devices) that may be unavailable locally.

Besides, the trend of market-demands forms another long term driver of technology adoption, for which institutions must prepare digitally focused graduates and align programmes and degrees with the needs of the industry (UNESCO-Institute of Statistics-IS, 2018; Facer, 2011). Certainly, HEIs have to adapt, design and custom-fit the Open Educational Resources (OERs), tools and resources to their needs (Becker et al., 2018; 2017). Otherwise in the short run, ICT adoption in education is needed to enhance efficiency in measurement, evaluation and documentation of teaching and learning practices and needs of students (EU Commission, 2014).

In practice, HEIs are increasingly subscribing to strategies which merge ICTs with pedagogies. This makes it compulsory to address such pedagogical shifts by connecting the particular ICTs and the actual learning experiences so that learners learn efficiently and become quality graduates (UNESCO-UIS, 2018). Given the expanding uses of ICT in all spheres of life, educational institutions are challenged to create environment where students can learn the appropriate use of ICT tools for academic and career purpose (PwC, 2018). Universities, in particular, are expected to intensify efforts to promote access to ICT infrastructure like internet, and OERs and support students' learning and participation in the 21$^{st}$Century society (Becker et al., 2018; 2017). Based on Green (2002), a university is the most internationalized and commercialized of the educational sectors (Trust Africa, 2012); such that, its multiplier effect to the economies makes it a strategic priority for global, regional and local movements and therefore critical for this nature of study. In this line, it is noted that, the emphasis to develop 'information-literate' graduates is fundamental to the credibility of higher education and manifestation of a post-modern university (Kuhl et al., 2019)

Earlier on, the United Nation's General Assembly's (2012) theme "*The Future We Want"* reiterated the international and institutional commitments to build science and technology capacity in education in line with the Millennium Development Goals (MDGs) (UN, 2013). The resolutions, specifically, called for support on ICT use by universities as a mechanism to bridge skills gap and advance sustainable development. The deliberations echoed the motive for universities to incorporate ICT to design quality and innovative programmes and promote lifelong learning. The advocacy for Research and Education Networks (NRENs) as powerful platforms for institutional collaboration and enhanced practices of ICT use in teaching and learning also marks one of the impacts of this UN's general assembly.

Afterwards, the United Nation's (UN) Incheon Declaration in Korea (2015) constitutes commitment of education community to Sustainable Development Goal 4. It sets to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (UNESCO-IS, 2018). The Incheon agenda discussed the strategies to address the unfinished business of Education for All (EFA) goals and the educational related MDGs. The UN backs up ICT and digital literacy in particular as strategies to accelerate the attainment of these SDG 4 aspects. According to the World Education Forum (WEF) (2015), ICTs can be harnessed to expand participation (access), improve quality and increase efficiency in education which are key indicators of SDG 4 (Targets 4.1, 4.4 and 4.7). This seems to have made a lot of sense because universities globally have shown interest with ICTs, and its connection to the cited SDG targets has become a common expression.

Realising the global social and economic value for ICT use, some practical responses with an African perspective include the African Union's (AU) Agenda 2063 (The Solemn

Declaration 2013). It established the *Continental Education Strategy for Africa* (CESA) to implement the AUs initiatives in line with the UN's Education 2030 agenda. Some evidence includes African Digital Schools Initiatives (ADSI) in Rwanda, Tanzania, Kenya, Senegal and Cote d'ivoire among others (African Union Commission-AUC, 2015). The Djibouti Conference (2017) on Higher Education Policy and Research, Quality and future challenges of Eastern Africa also revitalized the desire to strengthen ICT transformative capacity of HEIs (UNESCO-Regional office for Eastern Africa, 2017). These initiatives provide some evidence that, countries in Africa, just like those in Asia, Americas and Europe have commonly adopted the UN's tune for SDG 4 with respect to ICT use.

The UNESCO's Digital Literacy Framework (DLF) recommends for countries and entities using ICT in education to develop curriculum and assess digital literacy within their means (UNESCO, 2018). Five requisites in the context of teaching and learning relate to the purpose of technology use; competency areas and competencies; learning domains; modes of how learning tasks should be performed and; the digital tools to be included (UNESCO, 2018). Given the current digital divide, however, the requisites may vary in terms of contexts, scope, and level of development of a particular country/entity (Facer, 2011). For example, the North America, Europe and majority of Asian countries are already supporting universities to develop Massive Open Online Courses (MOOCs) (Handley, 2018). In contrast, the Sub Saharan counterparts lag behind and instructors can only adapt the content to the locally available and appropriate technologies (Internet Society, 2017). Developed countries like France, Finland, Norway and United Kingdom consider Digital Literacy (DL) as one of the basic literacies, just like numeracy, oral skills, reading and writing (Balas, 2015). Such a prioritization is not clear in many SSA countries, which implies that, learners

in universities and graduates may be struggling to learn and compete in the digital world' labour market (Spires et al., 2017).

The use of OER among university educators in the Global South varies regionally, with 49% in South America, 46% in Sub Saharan Africa and 56% in South East Asia. Some determinants here include instructors' level of access to ICT infrastructure (hardware such as computers and mobile devices) (Netro et al., 2017). By 2014, about 120 countries in Africa, Europe, America and Asia had been connected through the National Research and Education Networks (NRENs) as platforms for promotion of ICT use in HEIs (Internet Society, 2014). Citing the AAU data, the Internet Society (Ibid) indicate only nine (9) countries in Africa had matured NRENs, and majority of the rest were still in some stages to subscribe to the networks. This implies that, governments and other education actors in in Africa must intensify the support, mainly pedagogical, technical and budgetary, for universities to deliver the expected potentials of the ICTs.

World Bank, UNESCO, ITU, JAICA, AU (NEPAD), AfDB, and multinational companies like Ford Foundations, MacArthur, Carnegie Corporation of New York and Hewlett Foundations are supporting ICT for education-country specific initiatives in Africa. Such initiatives, for example in Kenya's include those on ICT-infrastructure such as Konza City, County Connectivity projects, National Fibre Optic Broadband Infrastructure, and Digital Migration. Those on e-learning and skills development include the Laptop Programme, Digital Learning Programme, and others (zero-rated taxes on imported ICT hardware and e-Government). Some of such initiatives in Uganda include the e-infrastructure, Research and Education Network Uganda, Broadband Services ERT Programme, National Backbone,

Migration from Analogue to Digital Broadcasting Project, e-Network project and Microsoft Innovation Centre, and the Huawei Initiative. Majority of these initiatives sought to address challenges of local content and general ICT mainstream in education.

The initiatives in Rwanda include the NEPAD's e-School Initiatives and UNESCO (KFIT project) among others. In South Africa, National Research Network and Tertiary Education and Research Network, the Digital Terrestrial Television Migration process, and SA Connect Broadband infrastructure rollout (Barakabitze et al., 2019) and the OER project at University of Cape Town-UCT (Common Wealth of Learning-CoL, 2012). Administratively, African universities are increasingly developing strategic plans which emphasize ICT use for teaching (ADEA, 2013). Apparently, countries acknowledge the potentials associated with ICT and as such have invested some resources to support its use in education. However, a significant ratio of the initiatives is still donor funded, which suggests that, the desired developments for the universities in Sub Sahara Africa may be delayed or may end up frustrating the ways ICT is used to support teaching and learning practices and desired students' attributes. Such a challenge makes it imperative for studies to probe the implementation of the technology potentials in order to inform its sustainability.

Recent reports for South Africa, Uganda and Senegal indicate that, students are widening the access to ICT devices such as mobile phones, which present opportunities for sustainability and scalability (Research in ICT Africa-RIA, 2019; World Bank-WB & African Development Bank-AfDB, 2012). However, the cost of the devices and lack of awareness on the internet use are the main barriers to Internet use. For example, 76%, 64%, 51% and 43% of the non-internet users in Mozambique, Tanzania, Uganda and Rwanda

respectively cannot afford Internet-enabled devices (Research in ICT Africa, 2019; Internet Society, 2014). As of 2018, less than 10% of households in SSA countries had computers and majority of learners accessed university as first time users of computers, Internet and e-mail (Blum, 2019; Kajee and Balfour, 2011). These challenges indicate that majority of these countries may have difficulties with out of campus ICT environment to support the educational potentials. Further evidence from Mauritius, Tanzania, Uganda, Ghana, Kenya, South Africa shows that, the knowledge and use of OERs among university educators is still inconsistent (Wolfeden et al., 2017; Netro et al., 2017). As such, although access to ICTs continues to be critical in Sub Saharan Africa, practices on how technology tools are integrated pedagogically for students' learning, as opposed to technology itself, remain under-explored.

Gilster (1997) used the term Digital Literacy (DL) in teaching and learning discourse to connote an ability to understand, appreciate and use information in multiple formats that a computer can deliver. The European Commission (2014) associates digital literacy with operational dimension (basic skills in ICT and the use of computers or another similar device) and informational dimension (skills to retrieve, assess, store, produce and to communicate the information and participate in collaborative networks via the Internet). The Commission on Science and Technology for Development (2018) categorised DL in two general levels; "*digital literacy for all*" as a basic requirement for every person to participate fully in the digital society, and "*digital literacy for individuals*" as basic education and literacy, as well as familiarity with technology devices which are sector specific. Central to this study, the National Academies of Science, Engineering, and Medicine (2017) stated a condition that, the curriculum practices which focus on developing

*digital literacy for all* should be inclusive and accessible to everyone. Indeed, since the curriculum practices already seem to be computer-skills based globally, equipping students with the appropriate digital literacy skills cannot be overemphasized (Michel et al., 2018). However, vague the term digital literacy may seem to be, critical to learning is the capacity to access, create and share, analyze, collaborate, evaluate, and communicate digital information in ICT environment (OECD, 2015; UNESCO-IS, 2018). Students' lack of such literacy skills can lead to plagiarism, difficulties in transfer of learning, inability to cite and quote browsed material; lack of internet navigation skills and fail in presentation (Jefferies et al., 2016; Yudi, 2013). These represent typical characteristics of unauthentic learning which can delay country's target for accessibility, quality and efficiency of learning and the UN Education 2030 agenda respectively.

UNESCO (2018) recommends for universities to design pedagogical practices which develop students' digital literacy skills required for learning in ICT environment (Nerland & Prøitz, 2018). Similarly, Kuhl et al. (2019) posit that, technology use policies and pedagogies should develop learner agency in students. Based on Wang (2011), one of (or) the following four (4) practices may be implemented to attain this; extra-curriculum activities (where Digital literacy is a course outside academic curriculum and; inter-curriculum, where Digital Literacy session(s) add-in to an academic course. Intra-curriculum practices present Digital Literacies into the available subject course. Lastly, Digital Literacy can be a stand-alone course(s) within academic curricula. Universities, however, must identify explicitly the activities that students should engage in order to avoid any systematic variations on how students conceive the intended practices (Balas, 2015). Furthermore, the pedagogical design to achieve this must synergize key components, such

as infrastructure, teacher training, and actual classroom practices (Michel et al., 2018; Nzuki, 2014). Irrespective of the type of practices, instructors are in a position to plan, facilitate and reinforce such practices because they deal with multiple-literacies of students' daily learning routines (McKnight et al., 2016; Wiegel, 2020). Ideally, instructors' preparedness to implement these associated roles will mean that, students have one of the important requisites to learn with the ICTs.

In Tanzania, the earlier National ICT Policy in 2003 indicated the government's intention to use ICT for service delivery (Ministry of Communication and Transport, 2003). Later on in 2007, the ICT Policy for Basic Education was developed to augment the use of ICT in formal education practices (MoEVT, 2007). The revised National ICT Policy (URT-Ministry of Works, Transport and Communication-MoWTC, 2016) was meant to address challenges related to ICT infrastructure for teaching and learning among other sectors. The Education Sector Development Plan (ESDP) for 2016/17 to 2020/21 in the context of Education and Training Policy (2014) is part of these solutions to strengthen ICT use across the formal education. Besides this, universities are entrusted to embrace ICT use in their Strategic Plans, as to contribute to priorities of National Development Plan 2016/17 to 2020/21 and the Tanzania Development Vision 2025 (MoFP, 2016). They are generally trusted to mainstream ICT into policies and other sectors' strategic plans (MCT, 2016). This makes them champions of implementing ICT use in both theory and practices and therefore valid for studies to interrogate their initiatives and leadership milestones in this regard.

At present, the ICT use in Tanzanian Universities is supported by a broadband connection to the world via the Eastern Africa Submarine cable System (EASSy), Southern and Eastern Africa Communication Network (SEACOM) and National ICT Broadband Backbone

(NICTBB) Optic Fibre Cable with capacity of 4.72Tbps, 1.28 Tbps and 4.8 Tbps respectively. Such infrastructure and the current tariff free import for ICT equipment have reduced the cost of backhaul transport bandwidth by about 99% compared to the situation back in 2009 (MoWTC, 2016; Mtebe, 2013). The World Bank's Science and Technology Higher Education Project (STHEP) contributed significantly to Education Management Information System (EMIS) and e-Library System, and digital content for end users (Trust Africa, 2012). TERNET also supports universities' capacity to use ICT in teaching and learning to complement scarce text books (Trust Africa, 2012). Despite all these solutions, 70.2 % of Tanzanian do not have access to internet which translates to only 1 % of households with access to the internet. In addition, 64 % of non-internet users cannot afford the internet enabled devices (RIA, 2019). This further means that, access to and skills to use the available ICTs continue to be a challenge both in and outside campuses. In a view of this, studies are needed to inform the best practices of how students can learn with the ICT.

Tanzania seems to have attractive ICT policies and development plans which prioritise ICT use (Ministry of Works, Transport and Communication-MoWCT, 2016; Ministry of Finance and Planning, 2016). However, the mixed feelings on e-readiness of her universities and trends of adoption and use of ICT in different forms of e-learning (Mtebe and Raphael (2018), Nihuka and Voogt (2012), and Tedre et al. (2010) suggest some information gaps to address. So far, certain ICT-related courses taught to new cohorts of students in universities indicate some opportunities for students to acquire digital skills for learning. Similarly, universities' subscription to both commercial and OERs like e-books and e-journals suggests a further critical development (Mtebe & Raphael, 2018). Despite the affordability challenges for ICTs like computers, smartphones, and the internet, mobile data penetration

has made it a relatively easier option of the internet for academic use. ICT subject in primary and secondary schools was meant to prepare students for learning with ICT at university level (Tanzania Institute of Education, 2010). However, professional developments of teachers in these levels are short of computer and other multi-media utilization (Ministry of Work, Communication and Transport, 2016). The impression across school system suggests that, students may be accessing a university as first time users of ICTs for learning. As such, they need dedicated support arrangements to comfortably adopt learning with ICTs (Nerland & Prøitz, 2018; Handley, 2018). The study exhausts some experiences at University of Dar es Salaam (UDSM) and Sokoine University of Agriculture (SUA), typical cases, strategically selected due to their size, history, location, age and track record of operations connected to implementation of ICT for education in the country.

### 1.2 Statement of the Problem

SDG 4 targets for access, quality and efficient learning in ICT environments require students to be digitally literate (UNESCO-IS, 2018). Universities in Tanzania are challenged to emphasize on digitization as a way to transform to Fourth Industrial Revolution (FIR) where a student is at the centre of learning experience in line with SDG 4 targets (Luhanga, 2019). Indeed, some attempts to advance ICT infrastructure and update pedagogies for training competitive graduates are evident (MoEST, 2018). Specifically, UDSM and SUA have subscribed to blended learning and online learning modes with some efforts to support students' digital literacy skills and at least bring them to minimum standards (Mtebe & Raphael, 2018). However, debates around the state of students' prior ICT experience, infrastructure constraints and instructors' capacity to implement ICT supported lessons (Barakabitze et al., 2019) indicate that, the selected universities have a lot

to do in order to support students' authentic use of the ICTs for learning. RIA (2019) shows that, 70.2% of Tanzanians do not have access to reliable internet, 64% cannot afford ICT devices and do not have internet operation skills. While ICT subject is optional and almost non-existent in primary and ordinary secondary levels, it is not evident in the curriculum for high secondary level (TIE, 2010). The available evidence suggests that, the teaching and use of ICT across education system is uncoordinated, techno-centric and apparently not integrated to pedagogies (MoWTC, 2016). While these elements present critical questions on how students learn with ICTs (Speckman & Mandew, 2014), the current study opted a perspective to explore the influence of University ICT environment on ways in which students *learn to learn* with ICTs. Grounded on Lave and Wenger's (1991) Situated Learning Theory, students' prior ICT background, university ICT infrastructure and pedagogical practices are key conditions to learn the authentic use of the technology. Such conditions determine the ICT use best practices and development of user's relevant digital literacy skills (OECD, 2018). That justified a need for this study to interrogate the influence of cited components of ICT environment on how students learn with ICTs in selected Universities. Therefore, the task of this study is to provide insights of the extent to which ICT is rightly deployed to sustain students' learning in universities which use the technology as per the UNESCO-IS (2018).

### 1.2.1 Purpose of the study

The study was an attempt to examine the influence of ICT environment for learning on the students' acquisition and use of digital literacy skills at University of Dar es Salaam and Sokoine University of Agriculture in Tanzania.

### 1.2.2 Specific objectives

Specifically, the study sought to accomplish the following objectives:

i. To explore the trends of digital literacy skills for learning among students at selected Universities in Tanzania

ii. To analyze the influence of teaching and learning activities on development of digital literacy skills for learning among students at selected Universities in Tanzania

iii. To evaluate the adequacy of basic ICT infrastructure for the development of digital literacy skills for learning among students at selected Universities in Tanzania

iv. To establish how prior ICT background knowledge influences the development of digital literacy skills for learning among students at selected Universities in Tanzania.

### 1.2.3 Specific Research Questions

The study sought to answer the following specific questions

i. What are the trends of digital literacy skills for learning among students at selected universities in Tanzania?

ii. What influence do the teaching and learning activities have on development of digital literacy skills for learning among students' at selected universities in Tanzania?

iii. How adequate is the basic ICT infrastructure for the development of digital literacy skills for learning among students at selected universities in Tanzania?

iv. How does the prior ICT background influence the development of digital literacy skills for learning among students at selected universities in Tanzania?

### 1.3 Significance of the study

The current study highlights the developments in terms of how Tanzanian universities are structuring the ICT environment and students' use of the ICT for learning. Therefore, the study firstly, helps to advance a description of the ICT environment and its support on students' digital literacy skills. Secondly, it contributes to theory development, by proposing the context-specific ideals to promote students' Digital Literacy skills for learning in Tanzanian universities. The findings of this study articulate the gaps between ICT (as a technology) and pedagogies. This is likely to enrich the curriculum experience that focuses on the intended learning objectives. The study provides a room for the universities whose teaching and learning employ some ICT use to benchmark against best-practices emerging from this study. The development of digital literacy skills for a university students is a sum total of practices from primary to tertiary levels. This has a policy implication on how the ministry responsible for education and its affiliate institutions can implement practices to promote students' use of ICTs. As such, this study informs the sustainability of ICT teaching practices across the formal school system.

It is clear that, substantial initiatives and support for ICT use in education have diverse focus. In order to speed up the benefits of ICT, studies must inform the sustainability of these initiatives. The study justifies the inclusion of digital literacy skills, as an area where government and donors' support and mentoring is needed for efficient, accessible and quality learning. This is crucial to employers because students' digital literacy skills

determine their success in learning and later on their employability. Therefore, the study may be a useful guiding tool to the development of context-specific digital literacy framework for learning and employability.

## 1.4 Limitations of the study

The researcher encountered several limitations in a course of this study: Firstly, the selection of study cases was purposive based on the involvement of universities in various ICT use operations of the country (Tanzania). Furthermore, the fact that there are no agreed up on rules/standards for the use of ICT for teaching and learning for universities in Tanzania, that makes the ICT environment and any practices unique to particular institution. This suggests that, the findings are only confined to the cases selected for the study unless they are validated for use in other institutions. A challenge of exploring the digital literacy skills for learning is the complexity of the definitions and diversity of opinions on the aspects of digital literacy skills for learning. That made it a condition to focus on only context-relevant digital literacy skills. Further important, the COVID 19 pandemic challenged the whole PhD program because it necessitated a change in schedules for face-to-face contact with supervisors. This was also a serious challenge during data collection because it limited the meetings which were the only practical modality for data collection.

### Delimitations of the study

In order to compensate for the cited limitations, the study adopted a constructivism approach, under which the findings and recommendations only serve as a reference for operations and studies in other universities which are implementing ICT use for teaching and learning. Given the diversity of digital literacy skills, the study adopted the standardized digital literacy skills

(*UNESCO's Digital Literacy Framework* and the Eisenberg and Berkowitz's *Big 6 Information Skills Model)* both of which offer some flexible connections with the needs in study area. In order to circumvent the limitations brought by the emergence of Covid 19 pandemic, paper based and electronic tools were developed in order to provide room for non-conventional meeting with respondents. The use of phone calls was adopted approach to follow up on instructors to complete and return the electronically shared tools. The study covered only two universities in order to ensure an in-depth understanding of the problem. Also importantly, the study planned for a smart field work, including the use research assistant to ensure that diverse respondents were reached within the conveniently available timeframe.

**Assumptions of the study**

The following were the major assumptions under which this study was grounded:

i. The selected universities are characterized by some forms of ICT uses in teaching and learning activities.

ii. Students must possess certain digital literacy skills in order to learn authentically in ICT environment.

iii. Relevant prior ICT experience, adequate ICT infrastructure in digital learning environment and ICT informed teaching and learning activities are determinants of students' development and use of digital literacy skills for learning.

iv. The pattern of ICT uses in actual teaching and learning (by instructors and students) will determine students' acquisition and use of digital literacy skills

## 1.5 Theoretical Framework

**The Situated Learning Theory** as propounded by Lave and Wenger (1991) is better suited to guide this study because it explains the necessity and approaches for universities to create ICT environment to support students' authentic learning. The theory establishes that, learning is a social process by which knowledge is co-constructed. In other words, learning is situated in a specific context and embedded within a particular social and physical environment. The following *key tenets* characterizing *Situated Learning Theory* provoked a debate to guide this study:

The theory views "*an action as grounded in the concrete situation/culture or activities in which it occurs"*. This tenet implies that, the value of learning process cannot be fully described independent of the concrete environment that supports it. In this view, this study presupposes that they must embrace the motivation to use the ICT for learning and provide supportive ICT environment that can nurture students' digital literacy skills. Some critics against the tenet indicate that, how tightly the knowledge is tied to context depends on the type of knowledge being learned, and that knowledge is more context tied when it is only taught in single context (Bjork and Richrdson-Klavehn, 1989; Anderson et al., 1995). The critics extended the scope of this study to consider other contexts (prior ICT experience) which determine how students learn in university's ICT environment.

The theory also establishes that, "*Knowledge does not transfer between tasks*". The claim means that, because knowledge is tied to context of its acquisition, it will not be transferred to another context (Lave, 1988). The contrasting views under this tenet suggest that, there can always be either large, modest or no transfers of knowledge. As such, it will depend on

the amount of practices with the target task on the representation of the transfer task (Kotovsky and Fall side, 1989; Anderson et al., 1995). The critics are also in line with the *Theory of Generalization* (Charles H. Judd) and the Gestalt psychology's *Transposition Theory*, which acknowledge transfer of learning. The fact that ICT can mount lifelong learning and foster transfer of tasks and knowledge (Collins, 1988), that makes it imperative for universities to design pedagogies which do reflect on what students should do with ICT in school and as part of lifelong learning in workplaces. The study therefore confirms the extent to which instructor and students' activities design embed students' literacy skills to learn with the technologies at the university.

The theory further posits that, "*training by abstraction is of little use*": This suggests that universities have to design and implement concrete instructions that foster learning. Brown, Collins and Duguid (1989) extend this tenet by advocating for apprenticeships training. They highlight the value of pedagogies whose learning tasks subject students into authentic practices through activities and social interaction. This means that abstract instruction can be ineffective if what is taught in classroom does not support its applications. Critics to this tenet advocate for abstract instruction over concrete instruction because that (abstract instruction) leads to successful transfer (Anderson et al., 1995). In contrast, experientialists like John Dewey (1938) and proponents of Learning by doing theories like David Kolb (1984) posit that, learning occurs best when abstract and concrete instructions are combined. The debate motivated the need for a study to find out (if any) the form of instructions to develop digital literacy skills and its influence on how students learn with the ICTs (Dewey, 1938; Kolb, 1984).

It is argued in the theory that, "*instructions need to be done in complex Social phenomenon"*. According to Lave and Wenger (1991), learning is inherently a social phenomenon and therefore has to take place in a complex, social setting. The term '*complex*' defines the design of learning tasks (large tasks in large social components) students engage in, as opposed to holistic design by Kirschner & Van Merrienboer (2010). The term '*social*' means co-operative/group/team or a community of practice (Anderson et al., 1996). Contrasting views of this perspective caution about some detrimental effects of co-operative or group learning tasks; such as free rider, suckers, status differentials and ganging up (Solomon & Globerson, 1989). Otherwise, Anderson et al. (Ibid) recommend school set up that ensures thoughtful implementation and script of learning environment to guarantee learning.

Based on Lave and Wenger (1991) and Anderson et al. (1996), this study acknowledges the need to ensure a holistic design of tasks which develop students' digital literacy through complex tasks, separate tasks and their interconnections (Kirschner & Van Merrienboer, 2010). In addition, although ICTs offer the best opportunities for collaborative learning tasks, for example through Learning Management Systems and Social Networks, students have to be trained to participate individually and in groups, so that both individual and co-operative/team goals are achieved. Following this line of thinking, universities are expected to implement pedagogies which involve large tasks and its components through which students learn as individuals and as members of groups. Certainly, this study is a follow up implementation of global pronouncements and university choice to embrace the use of ICTs, designed to examine the status of the ICT environment and ways in which such environment determines students' acquisition of digital literacy skills to support learning.

As such, the findings aid recommendations to enrich the ICT environment in which students learn.

## 1.6 Conceptual Framework

The Conceptual Framework (Figure 1.1) provides the hypothesized interconnection between status of various aspects of ICT environment for each of the selected universities and students' acquisition of digital literacy skills that supports learning with ICTs. Based on key assumptions of the framework, best way to realize the potentials of ICTs for learning is to treat ICT infrastructure, actual teaching and learning activities and the community of practice (students' prior experience) as instrumental aspects in helping students to *learn how to learn* in the ICT environment. The interplay of the key variables is presented in Figure 1.1, and described thereafter:

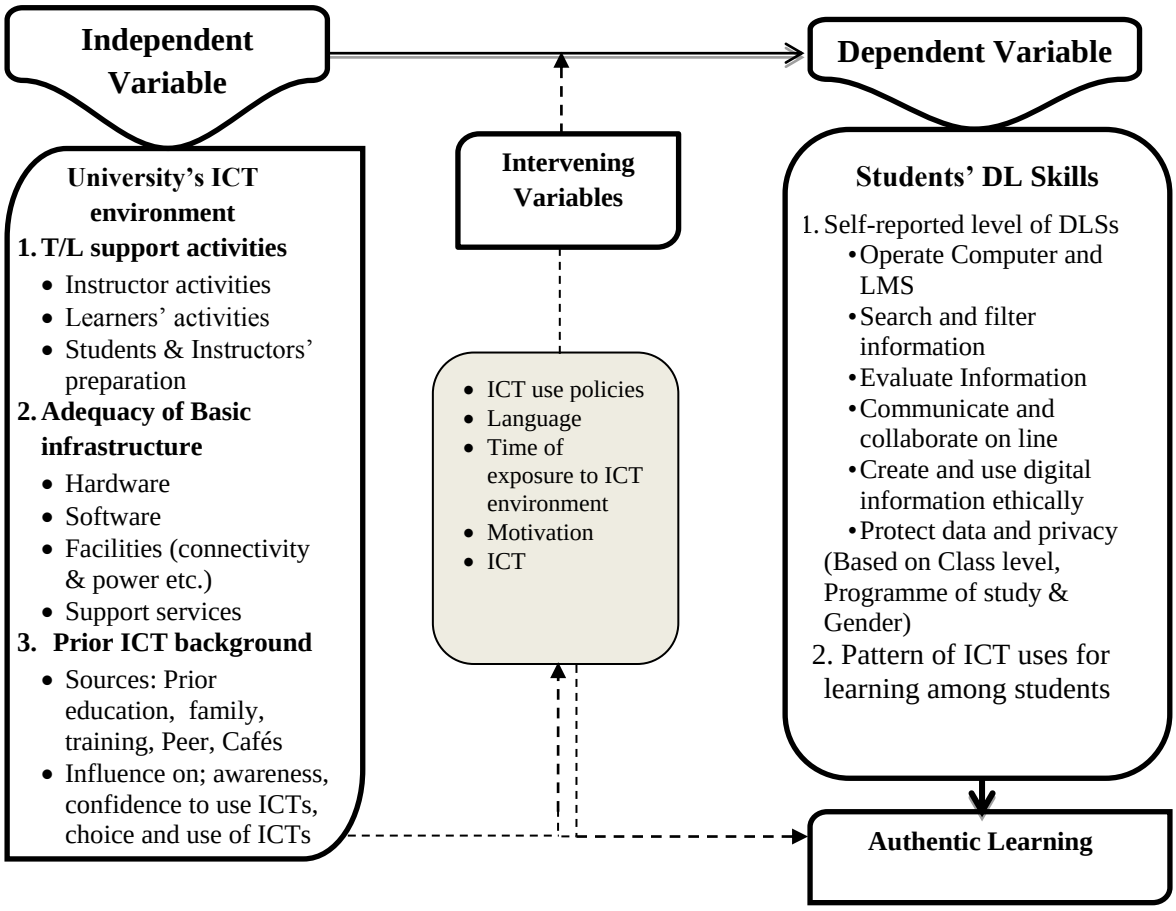



**Figure 1.1: Conceptual Framework: Influence of ICT learning environment for learning on Students' Digital Literacy Skills**
**Source: Researcher's construct (2021).**

Based on the Figure 1.1, the ICT environment constitutes key conditions for students to learn how to learn in ICT environment. The current study conceived certain aspects of ICT environment as determinants of the extent to which students learn by using the ICTs: The basic ICT infrastructure (hardware and software, computer laboratories, facilities) primarily offers the resources necessary for ICT mediated learning and actual learning practices. As such, users' conception of the availability and adequacy of such infrastructure has an implication on how they employ the relevant use. The guidelines and designs on how the curriculum embraces the digital literacy skills and its implementation in terms of teaching and learning activities means that the intended literacy skills are mainstreamed in practices.

Moreover, the ideal ICT environment adapts students' prior ICT background to help them learn appropriately by using the ICTs in context. Normally, technology (alone) does not guarantee its right use and therefore the expected learning outcomes. The environment that universities create to domesticate such technologies to make learners learn at best is what matters. The study adopted ICT environment as an Independent Variable for the purpose of investigating its influence of how learner learn with the ICTs at the university and workplaces.

The current study held a perspective that, digital literacy skills give university students requisites for learning in ICT environment (digital learning). The aspects of Digital Literacy Skills in this study are borrowed from *UNESCO's Digital Literacy Framework* (UNESCO-IS, 2018) and the *Big 6 Information Skills Model* (Eisenberg and Berkowitz, 1990). Such skills (which form a dependent variable for the study) include the capabilities to operate computers (or a similar device), create, manage, evaluate and share information, construct meaning, transfer learning and observe ethics in authorship. The level and use of digital literacy skills for learning are a function of students' prior ICT experience, availability of technology tools, guidance and continued use in the learning tasks. As such, students can develop disorders in learning with the ICTs if these requisites are not in order and may consequently jeopardize access**,** quality, and efficient learning. Such disorders include failure of transfer of learning, plagiarism, failure to cite and difficulties in information sharing, among others. The study further paid some attention to ICT use policies of a particular university, students' time of exposure to the technology environment; and language capability (as intervening variables). Such factors help to explain the engagement of students in digital literacy skills' development practices.

## 1.7 Operational Definition of Terms

### Basic ICT infrastructure

The Basic ICT infrastructure denotes a minimum of the hardware, software systems, and information and support services the University has in place to support context specific ICT supported instructions. The perspective of this study presupposed that, different universities may have different forms of ICT infrastructure and ICT supported teaching and learning practices.

### Digital Literacy Framework

This is a prescriptive reference which presents attributes, practices, skills and understanding of the "digitally literate individual. It may be used to provide guidance for digital literacy provision in the academic institution, guide the design of learning environment, curriculum experiences and set intended learning outcome.

### Digital literacy Skills for learning

Digital literacy Skills for learning refers to both operational and informational skills which enable a learner to learn in ICT mediated instruction. The phrase "literacy skills" is treated as aspect in a context similar to reading, writing and mathematics. Whereas the *operational skills* dimension entails the abilities to use computer, operating systems and browsers to navigate the web, the *informational skills* dimension entails the abilities to select, evaluate and re-use information available on the Internet).

### ICT Learning environment

This has been used to mean a set of factors which offer efficiency and effective use of ICTs for teaching, learning and the related functions in a university or another place to support

university teaching, learning and other related activities. Such factors which form ICT environment include (but not be limited to) ICT infrastructure (hardware and software applications), teaching and learning contents, plans and activities and students' ICT background which support students' ICT use for learning.

**Students' ICT Background**

This refers to both operational and informational ICT skills a student has by the time he/she is enrolled for university studies. The skills are obtained from previous schooling, community libraries, and peer platforms among others. The level of such skills determines their participation in university ICT mediated instructions.

**Trend of Digital literacy skills**

This has been used to mean variations and dynamics of students' digital literacy skills for learning across classes and programmes as a result of experience offered by the ICT environment in a university. These were assessed through a critical scrutiny of students' self-reported level of literacy skills and an investigation of their participation and use of ICT for various learning activities supported by ICTs across programmes, gender and years of study.

**Teaching and learning activities**

Teaching and learning activities has been used to refer to planned programmes objectives, contents, learning experiences, resources and assessment offered by the university. This also mean a total of strategies a teacher translate the formal curriculum in form of teaching for the growth of a learner. In this sense, a teacher takes consideration of learner's needs, background and interests and designs the instructions, teaching and learning environment and learners activities based on these considerations.

# CHAPTER TWO

# REVIEW OF RELATED LITERATURE

## 2.0 Introduction

This chapter presents materials from diverse literature to account for and justify the necessity of this study. The organization of this chapter is shaped by themes under individual specific objectives. The themes under review cover the trends of digital literacy skills for learning among students; Basic ICT infrastructure and students' digital literacy skills; influence of teaching and learning activities on digital literacy skills for learning among students and; influence of prior ICT background knowledge on development of digital literacy skills for learning. The chapter closes by highlighting the knowledge and methodological gaps and their practical implication to the current study.

## 2.1 Trends of Digital Literacy Skills for Learning among Students

Morgan, Sibson & Jackson (2022), carried out a study to establish a tridimensional (technical, cognitive and etiquette) conceptual framework and definition of digital literacy and investigate students' (N = 324) perceptions of their digital literacy proficiency by using an online survey. The findings based on multiple linear regression produced mixed results for different aspects of digital literacy. Students rated their proficiency lowest in using digital information, specifically in evaluating and ascertaining the quality of information. Students rated highest their proficiency for social literacy skills, such as communicating appropriately online. The findings noted minor differences between genders, while work experience and length of time in higher education had positive impact. The recommendations highlight the need to prioritise digital literacy adaptability in the

curriculum and ensure that, students are informed of the context-practices' skills to foster learning.

Secker's (2017) findings in Student Ambassadors for Digital Literacy (SADL) project present an experience of digital literacy development project for undergraduate students at London School of Economics-LSE (2013-2016). The project aimed to develop students' digital literacy and offer opportunity to explore students' digital needs. It engaged students and instructors through workshops and experimentation methodologies in a span of three years. A pre and post-programme study was conducted to establish students' changes as a result of the programme in terms of searching for and evaluating information, managing digital identity, managing and sharing information, and reading and research. Despite its achievement to cultivate digital behaviors, the programme left students with only small changes in the use of search engines, limited awareness of digital footprints and limited ability to critically evaluate digital materials. The findings indicate time and financial resource challenges to the sustainability and scalability of the project, which suggests that universities in the context of SSA and Tanzania in particular should be even more strategic to implement any strategies for DL development.

Sharimana et al. (2012) conducted a study on digital literacy of students in three Malaysian Universities, required to access and use digital contents for searching information in an internet based digital literacy tasks. The information in the digital contents were carefully selected to reflect the interests of youths and delivered through multimodal forms (including texts, images, sounds, animation and video clipping). After the digital tasks, students were asked to reflect on their digital literacy practices during the tasks and their everyday lives.

The findings noted high interest among students for multimodal forms of digital contents. However, students' language barrier limited their comprehension of contents. Students' lack of patience to navigate the digital contents and failure to spend time attributed a failure to critically understand the information. Students' low interest on the digital contents due to failure to reflect the students' local context raises a question on how instructors in SSA universities motivate students to use ICTs.

Lim et al. (2020) investigated male and female college students' use patterns of a Learning Management System (LMS) in an e-learning environment at a University in Korea. The focus of the study was to evaluate the structural differences between male and female college students in their LMS use patterns by using a multifactor model. By using 443 participants at the university, four factor structures with 14 items measured on a five-point Likert scale were employed for the analyses. After the confirmatory structures for each gender were modified, the equivalence was tested for factorial invariance and the latent means. The study observed that, for the three factors, male students used the LMS more than females. However, neither gender preferred communicating and collaborating with each other. The desire for the current study to look at gender factor for the pattern of digital literacy follows the appeal by Lim et al. (2020) to devise mechanisms to bridge gender digital divide and promote comprehensive strategies to mount participative LMS operations

Ay and Erdem (2020) used survey method to determine graduate and undergraduate students' Online Information Search Strategies (OISS) and their relationships on some educational variables. An online survey was administered to 1006 undergraduate and graduate students from Turkey and an "*Online Information Search Strategies Inventory"* for

measuring students' OISS. The study found that, students' level of OISS development was intermediate. The students perceived themselves most confident in "control" strategy which comprised skills for manipulating the online applications. Moreover, students were least confident about developing a skill to avoid disorientation. The study mostly linked the disorientation to problem solving. The findings depicted that, students who were confident in metacognitive information search behavior, were also confident in other information search skills. Particularly related to this study, the skills level for OISS was patterned on the basis of education level, programmes and increased requirement to do online information search for learning tasks

Samani, Noordin and Karimzadeh (2019) study examined the students' digital literacy according to their gender, programme of study, and background IT information among other variables. Using a quota sampling, the study selected undergraduate students of year 1 to year 4 in two Iranian public universities. The study noted that, male students displayed some competence in digitally related issues. Similarly, students studying in the fields under the umbrella term 'mathematical sciences' were the most digitally literate over those in 'humanities' counterparts. The findings further indicated that, the students who possess and use several digital tools during their daily life tend to report higher digital literacy than their peers who limit their digital activities to mobile phone. Furthermore, digitally more literate students had previously attended a course or workshop on ICT use related issues.

A descriptive study by Zhang, Wang and Liu (2021) had its motivation based on some evidence for gender difference in terms of Internet usage in China, where the Singleton daughters resulting from China's One-Child Policy enjoyed unprecedented parental support.

The study therefore investigated whether Singleton daughters could, to some extent break through the rooted digital divide. Based on a sample of 865 college students, the study employed Exploratory Factor Analysis (EFA) to identify clusters of Internet usage from the perspective of statistical associations in various daily online activities. The study further used a Two-way ANOVA and mean-comparison tests to analyze the pattern under which the singleton and non-singleton students used the internet differently. The study found that Singleton female students reflected no significant differences from male students in educational technology supported learning tasks. This implies that, the singleton female students had matched the skills level with male students in these activities. In a different test however, the level of skills of female college students from multi-child families still encountered difficulties to learn with the technologies.

A mixed methods study by Hall, Nix, and Baker (2013) explored students' experiences of digital literacy skills development with the aim to understand the motives for learners to engage with the skills content of their module at UK's Open University. Involving level 1 and 2 learners from three modules, the findings reflected some demographic determinants for the trend of digital literacy lessons design and participation. Such factors include program of study and level of study. Students at Level 1 who are relatively new to the university valued the digital literacy skills needed for the university studies. However, level 2 students took such skills for granted because they already had some previous experience and therefore focused on generic skills. This suggests that, the timing to embed digital literacy onto learners' school experience is an important consideration. Accordingly, majority of learners preferred to learn digital literacy skills in context of the subject they learn, and were motivated to use digital literacy skills which are relevant to their degree

contents/professional practices. While this is reported in literature (Edmunds, Thorpe and Conole, 2012; Levine et al., 2008), limited evidence for the nature of subject-bound digital literacy skills implementation necessitate more context-specific studies.

Tylor and Dalal (2017) survey investigated the college-aged students' evaluation aspect of information literacy skills with regard to Internet information sources. The study was based on the 2000 Association of College and Research Libraries literacy competency standards for higher education in one of the American Universities. The pattern of data provided strong indications of gender differences in information literacy skills. Female respondents discerned more than males in terms of the skills to evaluate Internet sources. They were more likely to use critical evaluation criteria like their understanding of a site, verification of the information on site, and the scrutiny of the credentials of the author; currency of a site and the quality of the writing/material layout on the site. On the other side, males emerged more confident in scrutinizing the credibility and accuracy of the search results from search engines.

Shopova (2014) conducted a survey involving 60 first and second-year students divided unevenly based on gender, from the Departments of Cultural Studies and Philosophy and Political Science from Faculties of Arts and Philosophy at South West University (Bulgaria). The study emanated from the experience that first and second year students encountered serious difficulties in learning, and therefore needed some support in terms of Internet use, and search and use of e-information. The objective was to analyze the extent and manner of ICT use by students in learning process. The study observed majority of young people who came to universities without study skills to operate in ICT environment. They were likely to develop superficial knowledge of ICT which do not contribute to

improved learning. Although the study does not show the difference in the level of digital literacy between the first and second year students, the findings provide a basis for the current study to investigate students' level of digital literacy, the timing and trend of supporting the use of ICT for learning over the university life span.

A mixed methods study by Byungura et al. (2018) investigated the digital literacy for first-year students at the University of Rwanda in order establish their trend of learning with technology. Data was collected during registration and orientation periods in order to capture the experience of students who had not gone through the pre-university ICT use environment. The study adopted accessibility, ownership, usage and previous computer-based training as determinants of the digital literacy. The study established that, majority of student respondents were digitally illiterate and never had any previous exposure to ICT mediated learning. The study further noted that, digital tools, like smartphones and laptops were accessed, owned and used by the majority, but rarely or never for learning activities. The findings also portray mixed levels of digital literacy due to differences in access, use and previous training on new technologies among the respondents. This means the different patterns of ICT use might also be a function of time of exposure to relevant ICT environment, access to technology tools and use guidance.

In the Tanzanian context, the study by Barabitze (2014) used secondary data to review the importance and inhibitors of initiatives to support learning with ICTs from primary to higher education level in Tanzania. The study reflects the Tanzanian government's objective to teach and ensure the use of ICT in primary and secondary schools as a way to prepare students for learning at University level (Tanzania Institute of Education, 2010). Barakabitze (Ibid) found serious inhibitors of ICT integration such as infrastructure,

competencies to utilise ICT among teachers and students, and attitude to integrate the ICT by teachers and administrators. The challenges suggest that, ICT is treated in a fragmented way in the Tanzanian school system and that students enrolled to universities may be facing serious challenges to use ICT for learning activities. This makes it imperative to establish the level and students' use of digital literacy based on the available ICT environment in order to recommend for strategies to enhance the technology uptake and thereafter authentic learning (Byungura et al., 2018).

## 2.2 Adequacy of ICT Infrastructure and Students' Digital Literacy Skills for Learning

A qualitative study by Thakur (2019) explored the effects of digital literacy skills on academic performance of students in Delhi public universities, India. The purpose, among other things, was to establish the implication of status of ICT infrastructure on students' digital literacy skills acquisition and use of ICTs for learning activities. The study established that, students who are exposed to adequate ICT infrastructure relevant to ICT supported learning practices in place are likely to develop lifelong skills to communicate, critically think, evaluate information, make use of information to develop concepts for research and innovations and self-academic reliance/trust. The findings of the study are used to emphasize the fact that, ICT infrastructure is critical determinant of how students learn in ICT environment. The findings provide justification to urge actors in the education system to prioritise ICT infrastructure, among other factors, in strengthening learning culture in ICT environment.

Nzuki's (2014) study employed secondary dataset to explore the theoretical and practical disparities towards *E-Learning Pedagogy Model in Africa.* The study established that

certain ICT tools made for optimal use in African higher education settings were either lying idle, inappropriately used or just wasted away because of the mismatch with user needs. The study further report that, some ICT tools never realized the appropriate use due to poor perceptive on the pedagogical strategies employed in training the users about its optimal usage. One of the assumptions guiding this study is that, web-based social networking tools such as Facebook, WhatsApp and Google Doc scan provide informal experiences to enrich students' digital literacies for academic use. However, Nziku (Ibid) shows that, such tools have been adopted in teaching and learning with serious misconceptions among teachers, students and administrators. Despite the relevance of these findings, the current study will likely address some pending questions in terms of how the ICTs owned by students, first, address the adequacy of the university ICTs; and second, shape the learning patterns of students. This information is crucial because it provides a clear picture of how the use of ICT is impacting on students' learning.

The study by Mathew *et al.* (2010) evaluated the World Bank's *World pilot* project (teachers' professional development) in Gambia. The evaluation's aim, among others, was to justify the use of the ICTs delivered by donors and whether they make a difference in ICT use for teaching and learning. The evaluation found that, the donated computers and internet connectivity did not work due to teachers' lack of appropriate training and supportive environment to design and implement the learning approaches. In line with the current study, since majority of developing countries still depend on donor projects for ICT developments (Nalaila, 2015; InfoDev, 2013; Mitchel, 2009), it is imperative to establish their suitability to locally available ICTs and teaching and learning models in the context. Studies are thus desired to explore the appropriately local models/frameworks for ICT use

which takes into account not only the universities' community of practices but also the kind of learning activities students engage in.

Studies on ICT infrastructure and how these determine learning include the survey for middle and primary schools in China (Chun Lu, Chin-Chung Tsai and Di Wu, 2015) and the UNESCO-IS's comparative analysis of ICT integration and e-readiness in schools across Asia (2014). In Africa, such studies include InfoDev (2013) and Mathew et al. (2010). In Tanzania, studies which indicate status of infrastructure, some practices of ICT use and perception of the challenges and opportunities in universities include Mtebe (2013), Mtebe & Raphael (2013), Bhalalusesa, Lukwaro & Clemence (2013), Tedre, Ngumbuke and Kemppainen (2010) among others. The experience in Tanzania, just like in other SSA country universities shows that, they are challenged by quality and adequacy of ICT infrastructure. The emphasis on how the available ICTs define students' digital literacy for learning does not feature clearly in literature about ICT infrastructure. This suggests a serious gap in systemic ICT implementation and how the technology impacts on students' learning. The synergy with other critical aspects of ICT environments such as pedagogies to support students' learning is unclear too, which justify a desire for the current study in the context of Tanzanian universities,

The functional relationship between ICT infrastructure and students' learning outcomes seems to be complex and inconsistently addressed. The experimental study by Banerjee & Duflo' (2003) on causality relationship between ICT infrastructure and learning outcome in Vadodara (India) established that, positive outcomes can only be assured under controlled experiments (uses), where a group uses ICTs in a certain way as opposed to the equivalent group which does not. The current study conceives that, ICT infrastructure creates platforms

for collaborative learning, facilitates students' centered learning, and provides access to diverse materials and flexible learning models. The current study concurs with Damsa et al. (2015), Nerland & Prøitz (2018), Kozma (2004) in OECD countries and Mathew et al. (2010), and Nzuki (2014) in African context that, it is how the technology is used which matters for students' learning. Given the plurality of evidence on ICT infrastructure in Tanzania, and in many other SSA countries, this study aims to inform on the actual use of the available infrastructure for students' learning activities (Dahlstrom, 2011 & Smith and Caruso, 2010). The findings will contribute to the current literature on whether the available ICT infrastructure suffices to promote students' learning with the ICTs and possibilities for authentic learning outcome.

### 2.3 Teaching and Learning Activities and Students' Digital Literacy Skills for Learning

Sharpe and Benfield (2012) examined the policies and practices in nine UK institutions of higher education which had indicated some commitment and opportunities to promote students' ability to learn in the ICT environment. Under the *Supporting Learning in a Digital Age* (SLiDA) project, the study used institutional case design and the Sharpe and Bethams' (2010) *developmental framework* to explore the curriculum practices which support learners' effective use of technology. The study had assumed that, the access to and understandings of technology do not explain the patterns of its use. Findings indicated that, the studied institutions were implementing some curricular activities which entail functional access, digital literacies development, personal practices and creative appropriation of the technology. Following this, Sharpe and Benfield (2012) caution against the failure to prepare students for learning in ICT environment and that some risks relate to difficulties to search and retrieve online information sources (JISC/UCL, 2008), manage and complete

online activities (Winter et al., 2010), to find time in the curriculum to develop competence in using technology (Buckley et al., 2010) and digital footprint gaps (Michel, Lutz and Büchi, 2018).

Studies increasingly demarcate students' functional digital literacy for academic from those for non-academic activities as students who afford computers and other similar devices still display improper use of such ICTs for academic work. Buston and Nui Sim (2013) conducted a scooping study on undergraduate students in New Zealand to examine on how twenty two (22) undergraduate students used their personal computers to support their academics. The study used two separate cohort groups from conveyance; one capturing Computer Activity Data and the other one drawing from Cohort Behavioral Data. The findings presented students as active computer users and literate in non-academic activities but with limited use on academic activities. This indicates that in certain environment, students still prefer paper-based learning despite increased penetration of digital resources and useful features of Learning Management Systems. Dahlstrom (2011) and Smith and Caruso (2010) posit that, students can be comfortable with technology and see it as integral to higher education. However, that depends on how universities model the academic use of the technology and monitor to see how the technology learning environment impacts on learning.

Instructors operating in ICT use-school contexts are entitled to preparatory arrangements for them to support students' efficient learning with ICT (Fourie and Krauss, 2011). Studies in Tanzania point out some challenges of teacher professional development in the school system, including the failure to address pertinent issues to enhance their performance (Kihoza, 2017; Anangisye, 2011; UNESCO, 2012; Nihuka and Voogt, 2012). Despite some

literature on ICT use in universities, details are inconsistent and unclear as to how universities' instructors design and implement activities to optimise digital literacy skills for students' learning in ICT environment. Nalaila's (2015) exploratory study on teachers' own competence to design and implement on-line activities for blended learning lessons at Mzumbe University (Tanzania) found that majority of them had limited capabilities. The workshops and trainings organised at the University did not adequately reflect the desired teaching practices in place. Other studies which would otherwise enrich the literature in the context of Sub Saharan Africa include Fourie and Krauss (2011) in South Africa. This means, with the growing use of ICTs in university settings, studies which monitor and inform the preparedness of instructors remain relevant and topical.

A wide range of literature seems to indicates a general consensus that, prioritisation of students' skills to use ICTs is one of sustainable models of teaching and learning in ICT environment (Wiegel, 2020; Shopova, 2014). Kuhl et al. (2019) posit that, technology use policies and pedagogies should be designed to develop learner agency in students. Specifically, university instructors' core role can determine ways learners make the desired use of technology for learning (Wiegel, 2020). The global impression based on state of art indicates that, the academic use of ICTs among students is a serious challenge, such that, digitally illiterate students are disadvantaged in learning. Although the curriculum practices already seem to be computer-skills based globally, the support on students' proper academic use of the technology is still limited (Michel et al., 2018; Secker, 2017). Consequently, students in many universities continue to make academically unacceptable use of the ICTs. For instance, besides the MOOCs initiatives in North America, Europe and majority of

Asian countries, Handley (2018) recommends for universities to prioritise instructors' capacity to support students' digital literacy for learning (Iinuma, 2016).

Majority of students in SSA have poor technology background and therefore use computers for the first time at university (Blum, 2019; Byungura et al., 2018). With such background, universities have a burden to orient such students on the desirable academic use of the technology (Mtebe, Fulgence and Gallagher, 2021). Students' unguided use of technology in learning has serious compromise on their relationship with instructors and the learning outcomes. Some students are likely to be upset by instructors' technology use which is different from theirs (English, 2016; Schmidt, 2012). The digitally illiterate students are also likely to be victims of academic failures caused by inability to operate ICT devices, use contents ethically, evaluate, communicate information and protect personal data and privacy (Breakstone et al., 2019; Michel, Lutz and Büchi, 2018; Shopova, 2014).

Scholars further recommend the value for classroom pedagogical practices to mount students' digital literacy skills for learning. Instructors are in a position to plan, facilitate and reinforce such practices because they deal with multiple-literacies of students' in daily learning routines (McKnight et al., 2016). The design of student learning tasks should reflect a synergy between technology, pedagogies and contents (Nerland and Prøitz, 2018). Further, Meyer et al. (2013) conceive that, instructors should be able to influence students' use of learning resources and the culture of collaboration. Therefore irrespective of the nature of technology in place, the arrangements and pedagogies attached to students' use of learning have influence on students' mastery of the technology use (Rahayu & Sapriati, 2018). Based on this review, the current study conceived the classroom experience as a

determinant of how university infrastructure, policies and pedagogies are translated into students' authenticity of technology use

### 2.4 Students' Prior ICT Experience and Digital Literacy Skills for Learning

The study at University of Leuven (Verhoeven Jef C., Heerwegh Dirk & De Wit Kurt, 2014) investigated university students who had been at the university for at least a year and were supposed to be familiar with the ICT environment and the expectations of staff about ICT use in and outside classes. The study tested the hypothesis that' "*a positive ICT learning experience at home, in school, and with peers contributes to mastery of higher level of ICT skills and more frequent use of ICT among students".* The findings confirmed that, despite some differences in impact level, the best predictors for most of the digital skills include the age of students' exposure to computer use, self-study, previous ICT course at secondary level and peer support. In line with this perspective, Meyers et al. (2013) and Ilomäki et al. (2012) emphasize the importance of bridging the gap between students' prior technology experience to enrich the digital literacy skills for learning in universities (Sefton-Green et al., 2016). Pierroux and Kluge (2011) view that, out-of school ICT activities and tools like online chat and messaging applications, file sharing, social collaborations can be enhanced through appropriate pedagogical design and digital technologies to support formal learning. However, despite their opportunities to support digital literacy skills for learning, such experiences may have some insufficiencies such that universities must systematically address them to suit the learning practices in place (Ilomäki et al., 2012).

A multi-cases qualitative study by Burns *et al.* (2019) covering four countries in SSA (South Africa, Mauritius, Botswana, and Cape Verde) reviewed the technology use in

secondary schools in the sub-Saharan African context. The cases were purposively opted for the study and expected to elicit the most relevant information. Burns et al. (2019) observed that, countries in SSA have adopted a public-private partnership (PPP) approach to diversify the supply and demand of ICTs in secondary schools. This is true in Tanzania, where collaborative initiatives are pertinent to support ICT in secondary schools and nurture students' digital literacy for use at university level (Tanzania Institute of Education, 2010). However, one of the critical challenges facing the ICT use in secondary schools is lack of readiness, in terms of physical, human, technical and educational requisites (Barakabitze et al., 2015). Despite some mixed experience (between public and private schools, poor and rich families and rural and urban based), majority of students in SSA countries miss out the ICT experience at this level and therefore are technologically ill-prepared to learn in ICT environment universities. As this may be valid also in Tanzanian context, it offers a motive for this study to explore ways on how universities respond to the lag challenge (UNESCO-IITE, 2016).

## 2.5 Summary and Research Gaps

The empirical review under this chapter has shown that, there is no short cut to authentic learning with ICTs unless the ICT environment is re-organised to support students' learning with the ICTs. As such, ICT environment is a predominant determinant of pattern and practices of ICT supported learning (Handley, 2018). School systems in developed countries are likely to be implementing more sophisticated ICT uses than the developing counterparts because of their financial muscles and developed ICT environment (Balas, 2016; Internet Society, 2014). Unlike Chun et al. (2015), Verhoeven et al. (2014) and Shopova (2014) who did surveys for the implementation of ICTs in universities, the current study is case-specific.

It compares two university cases in their natural settings to obtain a clear picture of how each of them supports students' ICT uses. Like in developed countries, developing countries (including Tanzania) are making some attempts to implement various forms of ICT supported learning. However, SSA universities (including Tanzanian) experience budgetary constraints which compromise a synergy for the components of ICT environment, namely, basic infrastructure, pedagogies, and preparedness of instructors (Handley, 2018 and Michel et al., 2018). As such, the current study is a demonstration of curiosity to the growing use of ICT for students' learning and therefore a need to explore the synergy and influence of components of ICT environment on students' digital literacy skills in Tanzanian universities. In other contexts, studies indicate serious learning challenges for students, who cannot operate basic ICTs, search, manage, share and evaluate information and who are unaware of ethics in writing (Meyers et al., 2013; Ilomäki et al., 2012). The current perspective draws from Tanzanian context, probing on whether the universities' set up is acclimatised to support the development of students' key skills to learn with ICTs. The choice of variables makes this a unique study built on empirical evidence on the degree to which ICT is rightly deployed to sustain students' learning in ICT environment.

# CHAPTER THREE

# METHODOLOGY OF THE STUDY

## 3.0 Introduction

This chapter presents the methodology adapted to execute the study. The chapter describes the study design, research variables, location of the study (and its justifications); population, sampling techniques, sample size and composition. The chapter further presents the types of data, methods and instruments of data collection, approaches to test for validity and reliability, data analysis plus ethics and logistical considerations.

## 3.1 Study Design

The design as conceived under this section is a plan of how the researcher intends to fulfill the purpose and answer the pre-identified questions (Patton, 2015). This study adopted a Case Study Design to describe the ICT environment for learning and the empirical regularities on students' digital literacy skills for learning at UDSM and SUA. A Case study describes in detail the cases/units in its context and tries to develop a complex picture of relationships between variables (Cohen, Manion & Morrison**,** 2018; Patton, 2015). The researcher compared two cases (UDSM and SUA) with an idea to augment the transferability of results between the cases (Lincoln & Guba, 2002). The comparison borrowed from George E. Bereday's (1964) Systematic Areas study approach, such that the situation about case(s) is described, followed by explanation about the presence/absence of desired attributes as per the objectives. The study further juxtaposes (determines) the information within and between cases, compares it and thereafter makes conclusions and recommendations (Bereday, 1964; Potts, 2007). Guided by Yin (2018), each university was

treated as a unit of analysis because the focus was on institutional context (Bray, Mark & Thomas, 1995). This served to get a comprehensive description of attributes around themes of each objective, specific for individual case and then between the cases (units of analysis).

Features identified by Creswell (2014) characterize this case study as predominantly qualitative. The study was carried out in natural setting and that the cases were selected on the basis of confirmed use of ICTs for teaching and learning. It also sought to elicit meanings that the actual participants hold on the current terms between ICT environment and students' digital literacy skills. The study further aimed to capture some descriptive data about demographic trends of digital literacy skills and ICT use especially for different degree programs, years of study and gender. The qualitative and descriptive data are blended in order to make the explanation of problem at hand more parsimonious and advantageous (Straus and Corbin, 1998). This further compensates for limitations of a single method and to ensure transferability of findings (Creswell, 2014). This qualitative case study employed multiple methods to collect and analyze data from each case at a time (Schofield, 2002). Given its comparative orientation, the analysis was carried out for each case separately (Eisenhardt, 1989; Bereday, 1964), and the findings from cases are compared to establish the similarities, differences, general patterns and recommendations (Huberman & Miles, 2002).

### 3.2 Research Variables

The study sought to explore the key aspects of ICT environment in universities and establish its influence on students' digital literacy skills to learn with the ICT. Conceptually, the

status of the universities' ICT environment determines students' digital literacy skills to participate in ICT enabled learning activities.

### 3.2.1 Independent Variable

An independent variable is the one which influences the outcomes (Creswell, 2014). The independent variable in this study is ICT environment and that the status of its components has influence on the students' level of digital literacy skills for learning. The first component of ICT environment in this study is basic ICT infrastructure (hardware and software, facilities and support services). This was measured by physically counting them and interrogating respondents' experience of its adequacy. Secondly, the teaching and learning support for digital literacy skills are reflected based on instructors and students' preparedness to use ICTs, and the design and implementation of teaching and learning activities. The researcher also interrogated various guidelines and frameworks to implement digital literacy skills development. Thirdly, the influence of students' prior ICT experiences was measured by interrogating respondents' school awareness of types of ICTs, confidence to use ICTs and ease of use of ICTs at entry to university. A student with some ICT experience is likely to adopt easily the university's mediated instruction, when other conditions are constant.

### 3.2.2 Intervening Variables

These variables stand between independent and dependent variables and exercise an influence of independent variable on the dependent variable (Msabila and Nalaila, 2016). In this study, intervening variables include technology use policies, language fluency and student's time of exposure to technology environment. Such factors help to explain the

impact of ICT environment and the nature of influence on students' acquisition of digital literacy skills. The study explores a link between these aspects with the independent and dependent variables to inform the sustainability of technology use at the university.

### 3.2.3 Dependent Variable

Dependent variables are outcome variables that depend on the independent variables (Creswell, 2014). The Dependent Variable in this study is *students' digital literacy skills for learning.* Normally, the availability of technologies does not guarantee its use for learning among learners, but the ways in which universities make learners learn at best. The students' *digital literacy* skills have been measured by students' own rating of digital literacy skills to participate certain ICT mediated instructions. This methodology also worked well with PISA's strategy to document ways in which students' access and use ICT resources in and outside school in OECD countries (PISA 2021 Framework, 2019). Students' digital literacy skills drew from *UNESCO's Digital Literacy Framework* (UNESCO-IS, 2018) and the *Big 6 Information Skills Model* (Eisenberg and Berkowitz, 1990). This was measured through the patterns of students' ICT use across gender, year and programme of study. Ideally, students' DL skills must be reflected on university's available ICT infrastructure and the design and implementation of teaching and learning activities. These arrangements should also take on board students' ICT prior background.

## 3.3 Location of the study

The study was conducted at University of Dar es Salaam (in Dar es Salaam city) and Sokoine University of Agriculture (in Morogoro region). The University of Dar es Salaam was established in 1961 as an affiliate college of the University of London and in 1963 as an

affiliate of the University of East Africa (UEA). In 1970 the University became an independent entity after the UEA split up. The main campus is urban located, at Ubungo area in Dar es Salaam city (A map Appendix E1). The Sokoine University of Agriculture (SUA) was established in 1970s as a faculty of Agriculture (under the University of Dar es Salaam) and later a full-fledged university through the Parliamentary Act No. 6 of 1984. The SUA's main campus is in Morogoro region (map appendix E2), 200 Kilometers from Dar es Salaam commercial city and 300 Kilometers from Dodoma Capital city. The following unique features of the selected universities align with the study topic and thus justify the selection:

Historically, UDSM is the oldest, followed by SUA that makes them parent universities in management, type of academic programmes and pedagogical practices that others in Tanzania emulate. The study universities host both unique and common degree programmes, ranging from pure science, agriculture and arts, which offer an advantage of heterogeneity (Schofield, 2002). Large size and number of students and staff in the cases compared to other public universities accounts for the motives to use ICT in teaching and learning. Scholars like Machumu & Zhu (2019) and Mtebe & Raphael (2018) confirm that, these cases are doing relatively better in integrating ICT in teaching and learning. More than 50% of publications (cumulatively) in ICT for education in Tanzanian universities are done by staff from these universities (Mtebe & Raphael, 2018). This also indicates that instructors have some capacity to support students' use of technology.

Strategically, UDSM and SUA are actively involved in various ICT initiatives in education (eg. STHEP, TERNET, African Virtual University (AVU) and the Partnership for Higher

Education (PHEA) and STEM related projects). This raises some conception that they might have garnered some experience that others can take on board. However, the UDSM's Computing Centre (UCC) which strongly supports the ICT environment certainly makes UDSM superior to SUA.

In addition, while UDSM is urban based, SUA is rural in nature, which presupposes some difference on how students experience technology penetration. While SUA is categorically agricultural university, UDSM has many other courses including pure, social and engineering sciences and Arts. This indicates that, the universities are heterogeneous in terms of programmes they offer (Schofield, 2002), that justifies their strategic importance for the study (Flyvbjerg, 2001). Therefore, the selection of these universities was meant to ensure that many programmes offered in other universities are reflected in the study. Further, this guaranteed relevant data (Edmonds & Kennedy, 2012) and high possibility of learning a great deal about ways in which students of different disciplines use ICTs for teaching (Saunders et al., 2016).

### 3.5 Target Population

Target population of a study is the actual focus or target of the research inquiry (Saunders et al., 2016). The target population for this study was students in Tanzanian public universities which use ICT for teaching and learning. By January 31st 2020, Tanzania had 12 public universities and about 220,000 students. Two universities, which make up 18 percent of the total public universities, were purposively selected to constitute the study cases. Based on TCU (2018), UDSM and SUA had a total of 31,727 and 11917 students in 2018 respectively. The cumulative number of students for the two universities represented over 30% of all students in the 12 public universities in Tanzania. UDSM and SUA also had over

1000 and 519 instructors respectively, making them also superior in terms of number of instructors over other public universities.

### 3.5.1 Sample Size

Gupta and Gupta (2012) recommend the use of sample in case the target population is large. The two public universities cases were selected to form 17 percent of the 12 public universities in Tanzania. The selection of cases was mainly purposive, based on history, age of establishment, track record of ICT use activities and involvement in numerous projects related to ICT use for teaching and learning. With approximately 20,000 and 10,917 undergraduate students for UDSM and SUA respectively the researcher projected to get access to at least eight thousand (8000) in total. These constituted the target population anticipated to participate in the study. This took into account the possibilities that, some factors might make it impossible to access students in all school/selected programmes/years of study. Such factors included Covid 19 precautionary measures, field works, practical sessions, sports, CATs and other activities based on university almanac (Lincoln & Guba, 1985). With such projections, a minimum of 10 percent of students was expected from each university to constitute a study sample (Best and Kahn, 2006). This allowed for a projection of a sample of 960 students in total (at least 480 from UDSM and 480 from SUA). Students are at the centre of this study specifically because they are considered to be victims of the design of ICT environment for learning. They are primary beneficiary of supportive environment and otherwise victims of unsupportive environment. Despite the qualitative nature of the study, which do not necessarily require large sample (Creswell, 2014), this relatively large sample was necessary because the descriptive part of the study sought some

descriptive details to explain the adequacy of ICTs and pattern of students' digital literacy skills (Yin, 2018; Straus and Corbin, 1998).

The target population also included teaching staff (instructors/lecturers) because of their teaching role to students. They are valuable source of information related to classroom support for digital literacy skills, ways in which students' use ICTs for teaching and trend of students' digital literacy skills. The teaching staffs for each university were selected based on the teaching workload for a semester during data collection. Based on the identified programmes and students sample, up to 100 instructors (from UDSM) and 70 (from SUA) among the accessible instructors (either physically or electronically) were requested to participate in the study. This made a sample of 170 instructors, whose summary is presented in Table 3.1.

### 3.5.2 Sampling Techniques

#### *Case Selection*

As of 30th January, 2020, Tanzania had a total of 12 and 18 public and private universities respectively (Appendix D) (Tanzania Commission for Universities, 2020). The study was conducted in two public universities (UDSM and SUA) which were selected purposively. The study took place in public universities because they are relatively similar in terms of sources of finances and management modality, which made them comparable. Moreover, the justification to focus on two cases draws in-depth nature of the information required, the desire for credibility, cost to conduct the study in more cases and the timeframe for the current PhD scholarship (Yin, 2018; Baškarada, 2014). The decision over the number of cases was also based on Creswell (2014) caution to provide ample room to identify themes

of the cases and conduct cross-case theme analysis. In line with Patton (2015), the selected universities are information-rich and typical cases to investigate. As such, that they were likely to yield insights and in-depth learning about the pattern ICT implementation in the country, rather than empirical generalisation.

Besides the criterion for selection of the cases, this study adopted the Stake's (1995) *instrumental case view* (whose focus is on the research problem) as opposed to *intrinsic case view* (which focuses on the study case) (Yazan, 2015). The justification for such focus hinges on the desire to get an in-depth description of a problem and objective conclusion terms for the relationships between ICT environment for learning and students' digital literacy skills.

***University students***

The study adopted a multi-stage sampling approach to select students in each university. In the first stage, Ten (10) clusters at UDSM were created to represent academic discipline, namely Natural Sciences, Agricultural Sciences, Social Sciences, Humanities, Education, Business, Engineering and Technology and Laws. Similarly, seven (7) clusters were created to represent the academic disciplines at SUA, namely Agriculture, Forestry & Wildlife management, Education, Veterinary medicine, Biomedical Sciences and Business and Humanities. This was meant, firstly to ensure an exhaustive representation from all academic disciplines of the selected universities; and secondly, to cross-tabulate the ICT environment and digital literacy skills based on academic discipline. In the second stage, one (1) programme was randomly identified to represent every academic discipline. This means, a total of ten (10) programmes represented the academic disciplines from University of Dar es Salaam and seven (7) from Sokoine University of Agriculture (to make 17

programmes in total). The selection of programs was informed by some evidence for ICT use for teaching and learning. In the third stage, students from the representative programmes were selected through a stratified proportionate sampling approach to constitute a study sample. This was done on the basis of Best and Khan (2006) recommendation for 10% proportion of the accessible population. In this regard, the study adopted the ratio to select students in 1st, 2nd, 3rd and 4th years of the representative programmes for each university. Despite the qualitative nature of the study, large number of students resulting from the proportional inclusion of different levels of studies was important to provide a picture of trends of digital literacy skills across programmes and class levels (Straus and Corbin, 1998), .

***Teaching staff/Instructors***

The study adopted stratified simple random sampling approach to select instructors who teach students of units/programmes selected for study. At least three (3), that is 50 per cent of instructors teaching a particular class in a semester were persuaded. Instructors' inclusion was based on their role to students' in relation to learning. Their selection considered gender factor and the use and non-use of the ICT. As such, the study involved both male and female instructors with and without records of ICT use for teaching. The study explored their opinion on general ICT environment, preparedness to support students' digital literacy skills for learning and the quality of students' participation in ICT-based learning and credibility of their academic outputs. The study adopted the use of a minimum of ten (10) per cent portion of accessible population to constitute the instructors' sample (Best and Kahn, 2006). A summary of the population composition, target population, sample size and sampling techniques is presented in Table 3.1

**Table 3.1: Population, Sample and Sampling Techniques**

| | UDSM | | SUA | | |
|---|---|---|---|---|---|
| **Respondents** | Sample size | Sampling Approaches | Sample size | Sampling approaches | Total |
| **Students** | 480 | A multi-stage sampling | 480 | A multi-stage sampling | 960 |
| **Instructors** | 100 | Stratified simple random sampling | 70 | Stratified simple random sampling | 170 |
| **Support Units** | 10 | Purposive sampling | 10 | Purposive sampling | 20 |
| **Key Informants** | 1 | Purposive sampling | 1 | Purposive sampling | 2 |
| **Total** | 591 | | 561 | | 1152 |

Source: Researcher's compilation (2020)

### 3.6 Instruments of Data Collection

The study sought to capture both primary and secondary data. Primary data was gathered by using interview (from didactics and technology coordinators and Library staff in each university); questionnaires (for lecturer and students), FGD (students) and observation checklist. Secondary data sought to capture records of activities in the Learning Management System, ICT use reports, course outlines, students' activities and assignments/papers. The study used multiple instruments to address the limitations of individual tools and strengthen the reliability of the findings (Creswell, 2002). The identified instruments are discussed below:

#### 3.6.1 Questionnaires

Questionnaires for both instructors and students include closed and open-ended questions for flexibility and to capture both direct and factual information (Creswell, 2014). This composition intended to allow for both descriptive and qualitative details on ICT infrastructure and patterns of teaching and learning activities, which needed responses from

large number of respondents (Kothari, 2004). The questionnaires, in line with the study objectives, were designed after a review of literature, but tailored to reflect the context of ICT use in the study cases and Tanzanian public Universities as whole. The researcher used both print and electronic questionnaires to provide some flexibility in terms of completion and submission.

**Questionnaires for students**

A questionnaire for students (Appendix A1) has two major parts; part sought to register students' personal details namely gender, age, year and programme of study. Such information was regarded important in determining trend of ICT use. Part two contains both open and closed-ended items mainly designed to capture descriptive details about the trend of digital literacy skills and patterns of ICT uses among students. Questions in this part also guided the rating of adequacy of ICT infrastructure and level of students' participation in digital literacy skills support activities and information on prior ICT experience and its influence on participation in learning activities at university. This helped to inform the link between entry ICT experience of students and Universities' arrangement to support the use of ICT. The instrument was designed in both electronic and print form altogether, impliedly, to determine the growing attitude and use of digital tools for academic use.

**Questionnaire for instructors**

The questionnaire (Appendix A2) sought to explore the instructors' support to students' digital literacy skills for learning. Following a structure almost similar to students' questionnaire, part one of this instrument sought personal details of the instructor respondents, specifically gender, age, work experience, rank and faculty. For part two of the

questionnaire, both open and close ended questions were designed to capture information on frequency of engaging students in ICT mediated activities; specific types of activities to support students' digital literacy skills and perception of adequacy of ICT infrastructure. Some open ended items also sought to capture instructors' experience of students' participation in ICT enabled learning activities and their opinion about its influence on quality of learning. The details were cross-examined with students' responses to inform the context relevant recommendations around ICT environment and students' digital literacy for learning.

### 3.6.2 Semi - Structured Interviews with Coordinators of ICT use for Teaching

Semi-structured interview (Appendix A 3.1) was administered to coordinators of didactics and technology units and library staff to get qualitative data on the synergy and coordination of university-wide practices to support students' digital literacy skills. In line with Rubin and Rubin (2005), the method is appropriate, especially because the objectives of the study was to establish *what* and *how* of the ICT environment and students' digital literacy skills for learning. Its' suitability also connects to its capacity to cover a range of attributes the study seeks and provides an understanding of the participants' own experience and feelings about their role and influence to students' learning with ICTs (Yin, 2003). With intent to confirm developments in the use of ICT, this method sought to probe the teaching and learning arrangements to support ICT use for students' learning. The responses were either tape recorded or written in a note book, depending on the readiness of the interviewees.

### 3.6.3 Key Informants Interview (KIIs)

The study administered in-depth interviews with key informants from the universities (Appendix A 3.2). Based on Cohen, Manion **&** Morrison **(**2018**),** Key Informants are knowledgeable about the aspects under investigation. The Deputy Vice Chancellors (academic) in the study universities were identified as key informants to clarify the position of universities in the implementation of the technology use. They were also approached to provide administrative and strategic orientations of universities with regard to investments in ICTs in terms of infrastructure, human resources and user competencies. This is important because teaching and learning practices are a manifestation of administratively strategic options as directed by state philosophy and policies and institutional strategic plans.

### 3.6.4 Observation Checklist

The study employed an observation technique to elicit first-hand information on various ICT use aspects in their natural setting to supplement other data sources (Cohen, Manion **&** Morrison**,** 2018**).** The aim was to strengthen the findings on what was theoretically claimed and what was actually happening on ground. A checklist (Appendix A4) captures the descriptive and qualitative attributes of the ICT environment and its usage, such as the number and quality of computers, internet connectivity, contents in the LMSs, power standby generators, availability and use of e-resources. The method sought to establish (descriptively) the ratio between some of the observable facilities to the demands of students. The researcher also observed classroom sessions involving students' presentation to confirm the use of ICTs for information sharing, and take notes and photos for the observed aspects.

### 3.6.5 Students' Focus Group Discussions

Focus Group Discussions are believed to contribute insights that are less accessible without the interactions and communication with a group (Gall *et al*., 2005; Morgan, 1988). The study recruited at least three Focus Groups of voluntary students from each university (each group with at most 10 students). This sought to collect opinions from students' experience on how they learn with ICTs. The study implemented two phases of FGDs; the earlier one sought to elicit baseline information on technology use pattern among students and a follow up phase which explored some clarifications based on responses from other instruments. As such, FGDs were expected to complement, extend, qualify or challenge data from other methods (Kothari, 2004).

### 3.6.6 Documentary Review

Based on Krippendorff (2004), this method is suitable for both descriptive and qualitative secondary data from textual and e-documents. The study reviewed course outlines, ICT use guidelines, ICT use reports, records of Learning Management System activities and students' papers and assignments to find out the types, patterns and quality of learning activities. The ICT use training reports revealed the type of skills both lecturers and students were trained in. This method saved time that would have been spent in the field study. Moreover, the documents saved for validation of data from other instruments (Yin, 2003).

## 3.7 Reliability and Validity of the Study

### 3.7.1 Pilot-testing of study instruments

Pilot-testing of instruments sought to establish their reliability, validity and practical effectiveness to address the study objectives (Wilson & McLean, 1994). The pilot study was

conducted at Mzumbe University, a public university in Tanzania, selected due to some reason: The researcher perceived a convenient access to right population, reliable feedback and adequate time to discuss the feedback with pilot respondents. The university is public and therefore reflects relatively similar features of study universities in terms of financing, admission criteria, and nature of curriculum practices. Questionnaires, interview guides and observation checklist were pilot-tested to improve content coverage and validity, clarity and cohesion of the questions. The pilot study involved (5) instructors, before whom the researcher read each question and asked the respondents to bring out any challenge/difficulty with the questions. The instructors were randomly selected from among instructors based in three faculties, who had classes to teach in a particular semester. Random class-based groups of students were also selected from degree programmes under faculties/schools where the selected instructors were based. Second year students were the only available group to select as the first year students were just doing their registration and the rest of students had gone for field attachment. The researcher also used the observation checklist to observe some ICT infrastructure, and students' modes of presentation. Students' typed assignment/papers from some instructors were also used to confirm aspects like typographical attributes, citation/references, ethics, and level of formality, cohesion and integration of arguments, which might be related to both operational and informational literacy skills. The feedback helped to identify and correct defective items by omissions of some items, rephrasing instructions, enrichments, grammatical corrections and re-organisation of contents.

### 3.7.2 Reliability of the Study

The study triangulated various sources, instruments of data and respondents to ensure that different types of respondents provide views and experience of the ICT environment in particular cases. This provided some confidence that, the information collected is rich and adequate to address the study objectives. The triangulation approach also helped to compensate for limitations of the same and hence increase some reliability. The researcher administered each instrument and data analysis and interpretation with high precision to allow for any audit trail to strengthen the reliability of instruments (Merriam, 1998). The instruments were crafted in a context relevant language and based on the roles of respondents to allow for both the researcher and respondents to perform their roles flexibly and precisely. Phone calls and e-mail communications were used for those participants who could not make it for face to face or paper responses.

### 3.7.3 Validity of the Study

The study used more than one sources and methods of data collection which precisely reflected themes around the variables to enhance validity. These were synchronized to confirm the emerging findings on similar themes, that is, triangulation (Merriam, 1998). This was meant to establish outcomes that are agreed upon by all instruments and respondents. The instruments are structured with precision in order to generate a true outcome, and contribute right inputs for valid findings (Merriam, 1998). The researcher further structured the fieldwork for all informants to have an opportunity to disclose their experiences in a balanced perspective (Cohen, Manion & Morrison, 2018). This also ensured that personal bias or incompetence by a researcher, which could compromise the research process and findings, was avoided.

### 3.8 Data Analysis

The study intended to establish the influence of ICT environment on development of students' digital literacy skills and participation in ICT supported learning. It adopted a Case Study design to interrogate two (2) purposively selected Tanzanian Universities. The study is qualitative in nature because large part of the findings entails verbal explanation. However, certain aspects of data in the study are descriptive (Yin, 2018), mainly in form of frequencies, percentages and ratios of ICT and Digital literacy skills attributes. Raw data from questionnaires, interview transcripts, discussion, observation and document were coded and then grouped into themes. On one hand, the qualitative data reflects respondents' opinion about students' digital literacy skills and quality of learning; ICT use preparedness of universities; ICT supported teaching and learning design, and students' ICT prior experience. These were analysed by thematic and content analyses approaches. On the other hand, descriptive data relates to demographic details, trend of students' digital literacy skills; ratio of ICT infrastructure against the demand and; pattern of ICT supported learning activities. These were analysed descriptively as categorical and continuous values/variables and be presented in form of numbers, percentages and frequencies. Based on the Bereday's (1964) Systematic Areas comparative study approach, the analysis did proceed from each case (separately) to a cross-cases analysis (Schofield, 2002; Eisenhardt, 1989). This was meant to aid comparison and to establish the similarities and differences of major themes and map the general patterns and recommendations (Huberman & Miles, 2002). Computer programs (mainly Excel and SPSS) were employed for both qualitative and descriptive analyses.

### 3.9 Logistical Considerations

The Graduate School-Kenyatta University approved the Proposal and wrote a Research authorisation letter to the National Commission of Science, Technology and Innovation (Kenya) to introduce and confirm the researcher' registration at Kenyatta University and validity to undertake the Doctoral research. The letter was further submitted to the study cases (University of Dar Es Salaam and Sokoine University) in order to obtain research clearance. The research clearances served as permission for the researcher to collect data from units in the respective universities. The research clearance was important for soliciting respondents' will and consent to provide data on agreed time and location. In setting up the appointment with respondents (towards the field work), the researcher provided a synopsis of the study to clarify the objectives and use of findings. The process of data collection and analysis took a total of six (6) months. Two (2) months were spent for writing a zero draft of the report. The researcher contracted two (2) research assistants (undergraduate students) one (1) from each university in order to provide assistance in the process.

### 3.10 Ethical Issues

Certain ethical issues were a priority of the study during the field work: The researcher sought participants' consent and assured them confidentiality so that they could speak at ease. Respondents' names and identities are not revealed to ensure anonymity. They were not compensated for their participation in the study. However, some drinks and bites were provided to them in case of the interview sessions carried out in times of breakfast and lunch. Moreover, respondents were informed about the freedom to withdraw from the study once they felt to do so. Neither photos nor recordings were made without respondent's willingness and consent.

# CHAPTER FOUR

# FINDINGS, INTERPRETATION AND DISCUSION

## 4.1 Introduction

The current chapter presents data interpretations and discussion of findings generally about ICT environment and its implication on students' digital literacy skills at University of Dar Es Salaam and Sokoine University of Agriculture in the United Republic of Tanzania. The presentation entails the demographic information of respondents, data presentation, and interpretation and discussion of findings, which takes a comparative nature between the cases studied. For each case, the focus is to address the following study questions:

i. What are the trends of digital literacy skills for learning among students at selected universities in Tanzania?

ii. How adequate is the basic ICT infrastructure for the development of digital literacy skills for learning among students at selected universities in Tanzania?

iii. What influence do the teaching and learning activities have on development of digital literacy skills for learning among students' at selected universities in Tanzania?

iv. How does the prior ICT background influence digital literacy skills for learning among students at selected universities in Tanzania?

### 4.1.1 Respondents' Demographic Information

The demographic attributes of students considered under this section include age, gender, and year of study (class), university affiliation, School/faculty and programme of study. The

attributes considered for instructors cover university affiliation, level of education, academic position, working experience and school/faculty. The attributes of other respondents are presented as per their roles in the study.

### 4.1.2 General Return Rate of Respondents for UDSM and SUA

The details in this section are analysed in groups of students, instructors, technical team members and key informants (Table 4.1).

**Table 4.1: General Return rate for UDSM and SUA**

| | UDSM | | SUA | | |
|---|---|---|---|---|---|
| *Respondents' category* | *Proposed Sample* | *Turned up* | *Proposed Sample* | *Turned up* | *Total turn up* |
| Students | 480 | 353(74%) | 480 | 368(77%) | 721(75%) |
| Instructors | 100 | 53 (53%) | 70 | 61(87%) | 114(67.1%) |
| Support Units | 7 | 5(71%) | 7 | 6(85%) | 11(79%) |
| Key Informants | 1 | 1 | 1 | 1 | 2 |
| Total | 588 | 412(70%) | 558 | 436(78%) | 848(74%) |

**Source: Field data (2021)**

The data presented in Table 4.1 shows that, a target sample size of 1146 was reached during the study. However, data for 848 (74%) respondents was collected and is therefore used for analysis in this study. These include 721(75%) out of 960 students; 114(67.1%) out of 170 instructors; 11(79%) out of 14 technical team members and; 2 (two) key informants. University-wise, the turn up denotes 70% for UDSM and 78% for SUA.

The data shows that, an average turn up of respondents is 74% on the whole. This suggests, firstly, acceptable sample size of respondents is attained; secondly, the respondents' composition is inclusive of the important actors around students' use of ICT and their digital

literacy skills for learning. This suffices the strength of research as proposed by Creswell (2014) that, multiple participants guarantee meaning that the participants hold about the problem or issue, not the meaning that the researchers bring to the research or writers from the literature. In the long run, the size and composition of cases and respondents account for the state that, the level of details/findings is undiluted as noted by Wolcott (2008a) in Creswell (2014).

On one hand, student respondents in each university were selected from defined programmes which represented other programmes in respective schools/colleges/faculties/institutes. On the other hand, instructor respondents selected for the study had some units/subjects with students in the selected programmes during the data collection semester. The aim was to ensure that, the perspectives from the two groups corroborate to provide findings that are more informative and are both context and time bound. The faculties and degree programmes from which students and instructors were selected are presented in Table 4.2.

**Table 4.2: Student and Instructors' Academic units (Colleges/faculties/institutes & Programmes)**

| University of Dar es Salaam-UDSM | | | Sokoine University of Agriculture-SUA | | |
|---|---|---|---|---|---|
| ***College/Institute*** | ***Students' Programme of study*** | ***No. of student*** | ***College/Institute*** | ***Students' Programme of Study*** | ***No. of students*** |
| Institute of Development Studies | BA. Development Studies-BA. DS | 32 | College of Social Sciences and Humanities | Bachelor of Rural Development-BRD | 44 |
| School of Journalism and Mass Communication | BA. Mass Communication-BA. Mass Com | 31 | College of Agriculture, Economics and Agribusiness | BSc. Agricultural Economics and Agribusiness-BSc. AEA | 45 |
| School of Education | BA. Education-BA. Ed | 31 | College of Veterinary Medicines and Biomedical Sciences | BSc. in Animal health and Production-BSc. AnHP | 46 |
| UD-Business School | Bachelor of Commerce and Accountings-BCA | 32 | College of Agriculture | BSc. in Human Nutrition-BSc. HN | 48 |
| College of Social Sciences | Bachelor of Arts in Library and Information Studies-BA. LIS | 31 | College of Science and Education | BSc. with Ed. (Informatics & Mathematics-BSc. Ed | 45 |
| College of Agricultural Sciences and Fisheries Technology | BSc. Agr'l & Natural Resources Economics and Business-ANREB | 32 | College of Forestry, Wildlife and Tourism | BSc. in Forestry | 48 |
| College of Engineering | BSc. Civil Engineering-BSc. Civ Eng. | 37 | SUA National Agricultural Library | Bachelor of Information and Records Management-BIRM | 41 |
| College of Natural Sciences | BSc. in Geology | 28 | | | |
| School of Law | Bachelor of Laws-LLB | 41 | | | |
| College of Humanities | Physical Ed. and Sports Sciences-PESS | 29 | | | |
| | **Total** | **325** | | **Total** | **321** |

Source: Field data-SUA &UDSM (2021)

The data in Table 4.2 present the clusters which were involved to represent academic discipline in the case universities. At UDSM, students and instructors were selected from Natural Sciences, Agricultural Sciences, Social Sciences, Humanities, Education, Business, Engineering and Technology and Laws. At SUA, respondents were drawn from clusters of Agriculture, Forestry & Wildlife management, Education, Veterinary medicine, Biomedical Sciences, Business and Humanities. This inclusion of diverse clusters and academic programmes sought to assure an exhaustive representation from all academic disciplines in the selected universities. Based on this advantage, the findings provide a comprehensive picture of ICT environment and digital literacy skills based on university-wide academic disciplines.

### 4.1.3 Gender Distribution of Student Respondents

The current study highlights gender as one of the determinants of variations on digital literacy skills and pattern of ICT use for learning among students (Stati & Torres, 2020). Indeed, UNESCO highlights gender balance in access and participation to quality learning as one of priority areas. In this study, gender is taken with seriousness in order to confirm any pattern of digital literacy skills based on gender at the selected universities (Mossberger et al., 2012). Information on students' gender distribution based on questionnaires completed is presented in Table 4.3:

**Table 4.3: Gender Distribution of Student Respondents**

| | **UDSM (N=324)** | | **SUA (N=321)** | |
|---|---|---|---|---|
| *Gender* | *Frequency* | *%* | *Frequency* | *%* |
| Females | 135 | 42% | 164 | 51% |
| Males | 169 | 52% | 153 | 47.8% |
| **Total** | **304** | **94%** | **317** | **98.8%** |

**Source: Field data (2021)**

The data given in Table 4.3 show that, out of the 324 responses analyzed for UDSM include 135 (42%) female students; 169 (52%) male students and; 20 (6%) who preferred not to identify their gender. At SUA, out of 321 students whose completed questionnaires are analyzed, 164 (51%) are females; 153 (47.8%) are males and 6 (1.2%) preferred not to identify their gender. The return rate on gender shows a marginal variation for gender representation between the universities: Over half of the respondents at UDSM are male compared to their female counterparts, whereas majority of the respondents at SUA are female (51%). More students at UDSM (6%) chose not to identify their gender compared to those at SUA (1.2%). This reflects the freedom respondents were accorded with as a way to ensuring the rights to provide information respondents were comfortable with (Cohen, Manion & Morrison, 2018). The general impression on gender-based return rate suggests some developments in efforts to attract gender balanced enrolment at least in the selected universities, a target by the Tanzania's Education and Training Policy (2014) (MoEST, 2014). Therefore, the findings in this study offer the best insights towards planning for instructions which seek to bridge gender gaps in learning participation (Taylor & Dalal, 2017)

### 4.1.4 Age distribution of Student Respondents

The study presupposed that, age of a student in universities has influence on motivation to adopt the use of technology. The current study sought to capture the age distribution of student respondents in order to establish any connection with the perception about ICT environment and level of digital literacy skills for learning. The data about age distribution among students for UDSM and SUA is given in Table 4.3.

**Table 4.4: Student Respondents' Age Distribution at UDSM and SUA**

| | **UDSM** | | **SUA** | |
|---|---|---|---|---|
| *Age group* | *Frequency* | *%* | *Frequency* | *%* |
| 16-20 | 27 | 8.9% | 22 | 6.9% |
| 21-25 | 260 | 80% | 244 | 76.6% |
| 26-30 | 36 | 11.1% | 39 | 12.1% |
| 31-35 | 2 | 0.6% | 11 | 3.4% |
| 36-40 | 0 | 0 | 4 | 1.2% |
| 40+ | 0 | 0 | 1 | 0.3% |
| **Total** | **325** | **100%** | **321** | **100%** |

**Source: Field data (2021)**

The details in Table 4.4 show that, majority of student respondents (80% at UDSM and 76.6% at SUA) is clustered under the age category between 26 to 25 years. This is followed by age group between 26 to 30 years (11.1% at UDSM and 12.2% at SUA) and between 16 to 20 years (8.9% at UDSM and 6.9% at SUA). As such, majority (over 99%) of student respondents are in a youthful age. This is a typical technology savvy group whose members are likely to be curious with the use of various forms of ICTs. However, this draws some cautions that, the productivity of their technology use depends on exposure to appropriate mentorship for the technology use. Unfortunately, although these

are branded as net generation, the tech-savvy, majority did not prefer filling the online questionnaire. To the researcher, that was an earlier indicator that, the interest of students to use technology platforms at least for research activities has not permeated the university culture.

### 4.1.5 Distribution of Student Respondents on Years of study

The study sought to ensure that, perspectives from students across academic years of study are captured to triangulate the experience with regards to ICT environment and also establish if there are variations on digital literacy skills based on academic years. Data about this aspect is given in Figure 4.1 and its interpretation thereafter:

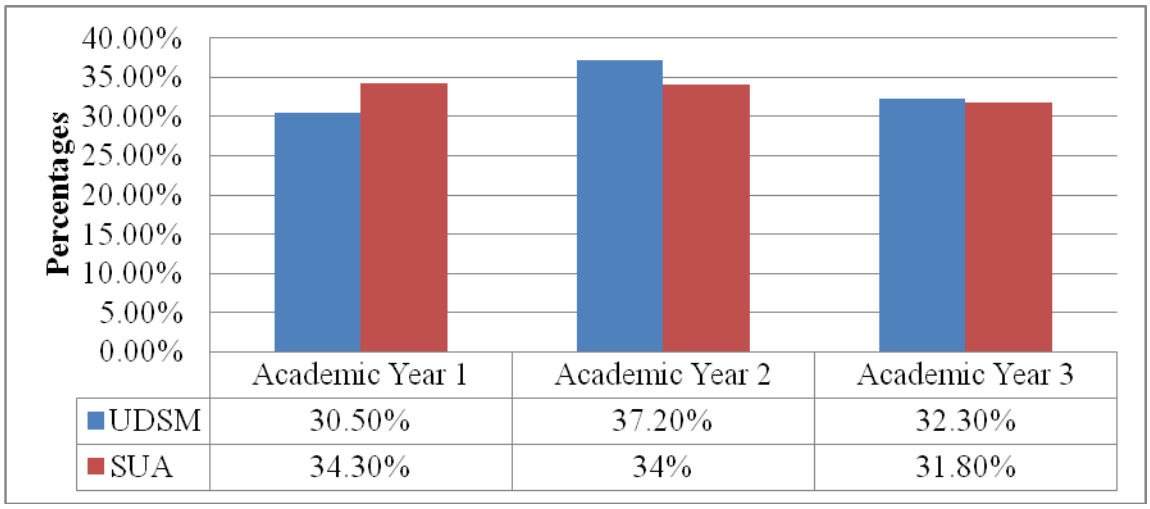



**Figure 4.1: Distribution of Student Respondents on Years of study**

**Source: Field data (2021)**

The data summary in Figure 4.1 shows a slight variation in number of students between the different years of study. For UDSM, majority of respondents draws from academic year two (2) (37.2%), followed by year three (3) (32.3%) and the least year 1 (one) that constitute 30.5%. Otherwise, at SUA, larger number of completed questionnaires were

collected from year one (1) students (34.3%), followed by year two (2) (34%) and year three (3) (31.8%). The variation is not surprising and does not reflect in any way the distribution of students in universities, but it is a result of availability of the students and readiness to participate in the study. Despite the variations of return rate from students attending different years in the selected universities, the return rate provides an impressive proportional representation for all academic years and that does not seem to have any negative effect on expected results.

### 4.1.6 Instructors' composition (Gender, Age, working Experience and Rank)

Instructors who were currently teaching or had taught the students in the selected programmes were requested to participate in the study. Their opinions are important because they reflect the ICT environment around the students and the learning practices which define the level of digital literacy skills of the students. The details about age, gender, level of education and working experience of the instructors are presented in Table 4.5 and described thereafter:.

**Table 4.5: Demographic details of Instructor respondents**

| | UDSM (N=53) | | SUA (N=62) | |
|---|---|---|---|---|
| ***Age group*** | ***Frequency*** | ***%*** | ***Frequency*** | ***%*** |
| ≥30 | 7 | 13% | 6 | 9.7% |
| 31-40 | 24 | 45% | 21 | 34% |
| 41-50 | 18 | 34% | 28 | 45% |
| 51-60 | 2 | 4% | 3 | 4.8% |
| Above 60 | 2 | 4% | 2 | 3.2% |
| **Total** | **53** | **100%** | **62** | **100%** |
| | | | | |
| ***Gender distribution of instructors*** | | | | |
| Males | 30 | 56.6% | 52 | 83.9% |
| Females | 23 | 43.4% | 10 | 16.1% |
| ***Level of Education of Instructors*** | | | | |
| Bachelor degree | 6 | 11.6% | 6 | 8.8% |
| Master degree | 25 | 47.2% | 13 | 19.3% |
| PhD | 22 | 41.5% | 43 | 71.9% |
| ***Academic Position of Instructors*** | | | | |
| Tutorial Assistant | 10 | 18.9% | 7 | 11.5% |
| Assistant Lecturer | 22 | 41.5% | 14 | 23% |
| Lecturer | 16 | 30.2% | 27 | 44.3% |
| Senior Lecturer | 5 | 9.5% | 9 | 4.8% |
| Professor | - | - | 4 | 6.6% |
| | | | | |
| ***Working Experience (No of years)*** | | | | |
| Bellow 1 Yr | 7 | 13.2% | 1 | 1.6% |
| 1-5 | 12 | 22.6% | 8 | 13.1% |
| 6-10 | 15 | 28% | 16 | 26.2% |
| 11-20 | 17 | 32.1% | 33 | 54.1% |
| Above 20 | 2 | 3.8% | 3 | 4.9% |
| | | | | |

**Source: Field data (2021)**

The instructors' distribution based on age (in Table 4.5) shows that, the majority (45%) of respondents at UDSM has age between 31 to 40 years, followed by those between 41-50 years. Up to 7(13%) respondents have age below 31 years and 4(8%) are above 50 years old. At SUA, 28 (45%) are aged between 41 and 50, followed by 21 (34%) in the

age between 31 to 40 years. Otherwise, 6 (9.7%) have age bellow 31 years, and 5(9%) with age above 50 years. The age distribution details suggest a diversity of opinions in terms of how different age groups perceive and experience the level of technology use for learning.

The details in Table 4.5 also present gender distribution of instructor respondents. At UDSM, more than half (56.6%) of respondents are males and the rest (43.4%) are females. At SUA, males are 52 (83.9%) while females are 10 (16.1%). Comparatively, while the picture for UDSM presupposes a fair gender distribution (given the mismatch of employment for males against females in universities), the impression at SUA highlights unbalanced representation. In some incidences, failure to complete questionnaires for some respondents indicated reluctance and fear to participate in the study, especially for the female instructors. Some female respondents chose to participate via informal interviews, under conditions to hide their identity. Nevertheless, the researcher strived to have a larger number of males to ensure validity of instructors' claims.

The study captured instructors' level of education between bachelor degree to PhD level. At UDSM, the largest (47.2%) instructors' segment holds master degree, followed by 22 (41.5%) holders of PhD and; the least, 6 (11.6%) holders of bachelor degree. Otherwise at SUA, majority (71.9%) of instructor respondents represents PhD holders; followed by 13 (19.3%) with master and 6 (8.8%) bachelor degree holders. Comparatively, the composition for both UDSM and SUA suffices a reasonable representation and therefore

diversity of opinions to describe the ICT environment and students' digital literacy skills for learning.

With regards to academic position/rank of instructors, majority (41.5%) of the respondents at UDSM comprises assistant lecturers; followed by 16 (30.2%) lecturers, 10 (18.9%) tutorial assistants and the least 5 (9.5%) senior lecturers. At SUA, 27 (44.3%) lecturers, followed by 14 (23%) assistant lecturers; 9 (4.8%) senior lecturers, 7 (11.5%) tutorial assistants and 4 (6.6%) Professors. Unlike SUA, the impression at UDSM shows a smaller number of instructors in the higher ranks (senior lecturer and professor). This suggests the impact of Covid-19 threats (in the Dar es Salaam City) among the older staff, majority of whom had to self-isolate. The threat was low at SUA because of its countryside location. However, the composition does not preclude the confidence that, opinions based on different ranks are reflected in the findings.

The findings on working experience show that, majority (32.1% and 54.1%) of instructor respondents (at UDSM and SUA) had working experience between 11 to 20 years respectively. This was followed by 28% and 26.2% (between 6 to 10 years); 22.6% and 13.1% (1 to 5 years) for UDSM and SUA respectively. However, UDSM had majority (13.2%) of respondents with the least experience compared to SUA (1.6%); while SUA had larger number of the most experienced instructors (4.9%) over UDSM (3.8%). The distribution, on the whole, provides triangulated inputs based on such diversely experienced instructors from both universities.

### 4.1.7 Information about ICT Support Units

The study further recruited respondents from ICT related support unit staff who work closely with students on the use of ICTs. At UDSM, these included three (3) Library staff who work to support students' informational literacy skills (1 female and 2 males) and; two (2) Moodle Coordinators (1 male and 1 female) who support instructor and students' use of Moodle LMS under the Centre for Virtual Learning (CVL) unit in the College of Information and Technology). Other specific ICTs and supports are taken care at School/faculty/college and departmental levels. At SUA, the Centre for ICT is responsible to overseeing the general ICT infrastructure and its use in teaching and learning among other university functions. Six (6) respondents appeared for FGDs, including three (3) from the Center for ICT and others from the Sokoine University National Agriculture Library (SNAL). The core qualification for the Moodle coordinators (at UDSM) and Centre for ICT (at SUA) is IT based, which implies their techno-centric orientation. The inclusion of these staff was important to justify the nature of ICT environment and support accessible to students.

### 4.1.8 Information about the Key Informants (KIs)

Key Informants in this study were recruited as knowledgeable personnel about the ICT environment and state of Digital Literacy Skills in the selected Universities. Although the target identified Deputy Vice Chancellors for the roles, complications associated with their logistics made it difficult to access them. The IT manager (at UDSM) and an appointee of Director for University Library (SUA) assumed the KIs role for this study. This turned to be advantageous as the incumbency demonstrated adequately rich information which helped to justify bureaucratic and technical position of University's

ICT environment contradictions between the two angels. This was an important opportunity for the study because it provided insights of a tendency where administrators want to implement reforms that are technically impractical.

## 4.2 Findings for the Specific Objectives

### 4.2.1 Trends of Students' Digital Literacy Skills for Learning

The study was an attempt to answer a question *"What are the trends of digital literacy skills for learning among students at selected universities in Tanzania?* The trend in this context means any developments and variations of students' digital literacy skills for learning across gender, years and programmes of study. Two dimensions of the digital literacy skills considered in this study cover operational skills and informational skills respectively. On one hand, the operational skills represent the fundamentals of computer hardware and software, which describes one's understanding of computer's operating systems and Learning Management System in place. On the other hand, informational skills represents one's abilities to identify and search for information, create contents, manage, evaluate and share information and observe ethics in writing (UNESCO-IS, 2018).

Descriptive data to address this objective draw from close-ended questionnaires given to students and instructors respectively. Student-based descriptive data present students' own perceived levels of digital literacy skills and pattern in the use of such skills. Instructor-based descriptive data (from teaching staff) serves to explain the frequency at which students are engaged in ICT supported learning tasks. Qualitative data was garnered from FGDs (with small groups of students), informal discussions (with

instructors), Interview (technical team members, who include ICT and Moodle LMS coordinators and Library personnel). These were considered useful to inform the study on nature of ICT environment and its influence on students' learning experience. Further qualitative data draw from researcher's personal observation and review of records of students' learning tasks and curricular for digital literacy related subjects.

#### 4.2.1.1 Student's Self-reported Level of Digital Literacy Skills at SUA and UDSM

##### 4.2.1.1.0 Operational Digital Literacy Skills

The study explores the level of students' digital literacy skills for two areas of operational competency; namely, basic computer operation skills and Learning Management System (LMS) operational skills. A five (5) points Likert scale items-based questionnaires for students was used; where 1 represents basic level (for a learner), 2 for novice (with limited knowledge; 3 for intermediate (with limited practical application; 4 for advanced level (mastery) and 5 for experts (professionals).

##### 4.2.1.1.1 Basic Computer Operational Skills

In the first place, students were asked to reflect on their level of skills to perform basic operation of a computer or a similar device. This covers a general understanding of operations about turning on/off, charging, locking computer and using a computer for learning related tasks, especially the MS Word and Excel applications as a threshold. Challenges on such capabilities make it impossible for a student to navigate the elementary uses of computer or a similar device for learning. Figure 4.2 presents the summary of findings and its interpretation thereafter.

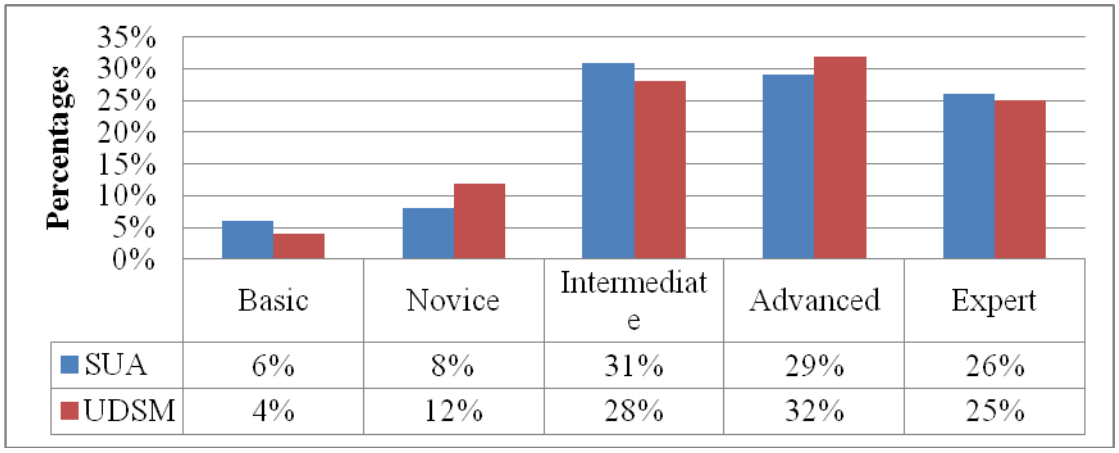



**Figure 4.2: Basic Computer operational Skills**

Source: Field data (2021)

With regards to basic computer operations at SUA (Figure 4.2), 100(31.2%) students rated themselves at intermediate level of skills. This means they have some theoretical understanding of computer operations but still encounter practical limitations. A total of 94 (29.5%) students claimed to have advanced skills level, which indicates a mastery of the operations and other 83 (25.9%) students asserted to be experts and therefore can perform the basic computer operations generally with precision above average. A total of 25 (7.5%) students rated themselves novice, which means they still possess limited operational knowledge. The least, 19 (5.9%) are at basic level, as they are still learners. At UDSM, 13 (4%) students are learners; 39(12%) are novice and 90 (28%) students have intermediate level. Others, 103 (31.7%) and 80(24.7) have mastery and expert levels respectively.

The descriptive data presents a general picture that, majority (56.2% and 55.4%) of student respondents at UDSM and SUA rated their skills level between advanced and professional. This means, they have skills above average and therefore can operate the basics of computer (or a similar device) and easily learn further operations to mount

confortable computer use for learning. Comparatively, this indicates a significantly large number of students who have confidence to operate the basic features of computer (or a related device). This means, such students have a necessary requisite to learning more features with a computer. These students can be easily trained for further specific skills to support learning; such as speedy typing, information searching strategies and operating Learning Management Systems. However, the rest (43.8% and 44.6%) of students at UDSM and SUA have skills' level between basic and intermediate, therefore, may not be able to use the computer or a similar device for learning. The observation here is in line with Tang & Chaw (2016) study, which observed that, computer operation skills promote some understanding of safe ways to use a computer or similar device. Such attributes add on more confidence for a student to navigate more features of the computer which are related to learning.

As such, the state that many students in universities can operate the basics of computer implies preparedness of such students to learn with ICTs. Some experiences show that, issues with regard to operational skills at university level depend on how coordinated the ICT backgrounds are (Blum, 2019; Byungura et al., 2018). This has both long and short term impact on how students use computer for learning tasks. For example, Mungwabi (2019) noted that a substantial count of university students who demonstrated serious deficiencies in computer use at UDSM had used computers for the first time at the university.

The study carried out a cross-tabulation in order to establish if the responses are patterned with programmes of study, year of study and gender. The findings are presented in Table 4.6, 4.7 and 4.8 respectively.

#### 4.2.1.1.1.1 Programme of study versus Basic Computer Operation Skills

Table 4.6 presents the results based on a cross tabulation which sought to ascertain if the basic computer operation skills are skewed with programmes of study:

**Table 4.6: Programme of Study versus Basic Computer Operation Skills**

| | | *Levels of Basic Computer Operation skills* | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Programme | BSc. AEA | 28(62%) | 8(17%) | 81(7%) | 1(2%) | 0(0%) | 45 |
| | BSc. AnHP | 10(22%) | 11(24%) | 15(33%) | 6(13%) | 4(9%) | 46 |
| | BIRM | 8(20%) | 16(39%) | 10(24%) | 5(12%) | 2(5%) | 41 |
| | BRD | 2(5%) | 17(39%) | 23(52%) | 2(5%) | 0(0%) | 44 |
| | BSc. Forestry | 16(33%) | 14(29%) | 13(27%) | 4(8%) | 1(2%) | 48 |
| | BSc. HN | 8(17%) | 20(42%) | 16(33%) | 3(6%) | 1(2%) | 48 |
| | BSc. Ed. | 11(24%) | 8(17%) | 14(30%) | 2(4%) | 11(46%) | 46 |
| Total | | 83(26%) | 94(29%) | 100(31%) | 22(7%) | 19(6%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Programme | BA. DS | 8(25%) | 14(43%) | 7(22%) | 3(9%) | 0(05) | 32 |
| | BAED | 5(16%) | 8(26%) | 10(32%) | 8(26%) | 0(0%) | 31 |
| | BA. Mas Com | 4(13%) | 10(32%) | 11(36%) | 6(19%) | 0(0%) | 31 |
| | BCA | 4(13%) | 12(38%) | 7(22%) | 8(25%) | 1(3%) | 32 |
| | BA. LIS | 5(16%) | 8(26%) | 12(39%) | 4(13%) | 2(7%) | 31 |
| | BSc. ANREB | 9(28%) | 9(28%) | 12(38%) | 2(6%) | 0(0%) | 32 |
| | BSc. Civ Eng. | 12(32%) | 10(27%) | 7(19%) | 6(16%) | 2(5%) | 37 |
| | BSc. Geology | 10(36%) | 6(21%) | 9(32%) | 2(7%) | 1(4%) | 28 |
| | LLB | 15(37%) | 19(46%) | 6(15%) | 1(2%) | 0(0%) | 41 |
| | PESS | 8(28%) | 8(28%) | 5(17%) | 1(3%) | 7(24%) | 29 |
| Total | | 80(24%) | 104(32%) | 86(27%) | 41(13%) | 13(4%) | 324 |

Source: Field data (2021)

The details based on cross-tabulation (Table 4.6) show some variations among students of different programmes in terms of levels of skills to operate computers for learning

activities. At SUA, BSc AEA has the largest majority of students (80%) with skills above average. This is followed by BSc. Forestry (63%), BIRM (59%) and BSc. HN (58%). Other programmes have majority of students who rated their skills below mastery: These include BSc. Ed (59%), BRD (57%) and BSc. AnHP (54%). Similarly, six programmes at UDSM have majority of students who rated their skills to operate computers above average: These include LLB (83%), BSc. Civ. Eng. (73%), and BA DS (69%), BSc. Geology (57%), BSc. ANREB (56%) and PESS (55%). Majority of students in other four programmes rated their skills as limited (below mastery). The findings show that, both universities manifest some variations within and between programmes. However, such variations do not seem to offer a direct connection to nature of such programmes such as arts, engineering, science and humanities.

The observation indicates that, initiatives (if any) to foster computer use in both universities are not uniform across programmes. Samani, Noordin and Karimzadeh (2019) observed that, students in the fields of 'mathematical sciences' rated themselves more literate in operational aspects of PCs over those in humanities disciplines because of an advantage of using PCs for learning than the counterparts. While this may also be true in the current study, further impression seem to suggest that, the variation is determined by the instructors' pressure on students in some programmes to use PCs, not necessarily due to the nature of programme (National Academies of Science, Engineering, and Medicine, 2017). As such, universities are challenged to strengthen university-wide arrangements to support students' acquisition of the skills.

#### 4.2.1.1.1.2 Gender versus Basic Computer skills

The results for a cross-tabulation conducted to establish the variations of students' basic computer skills with gender are presented in Table 4.7.

**Table 4.7: Gender versus Basic Computer operation skills**

| | | ***Levels of Basic Computer Operation Skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| *Sokoine University of Agriculture* | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Gender | Female | 44(27%) | 52(32%) | 40(24%) | 18(11%) | 10(6%) | 164 |
| | Male | 37(28%) | 40(26%) | 60(39%) | 7(5%) | 9(6%) | 153 |
| Total | | 81(26%) | 92(29%) | 100(31%) | 25(7%) | 19(6%) | 317 |
| *University of Dar es Salaam* | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Gender | Female | 34(25%) | 45(33%) | 31(22%) | 19(14%) | 6(4%) | 135 |
| | Male | 38(23%) | 56(33%) | 48(28%) | 20(12%) | 7(4%) | 169 |
| Total | | 72(25%) | 101(32%) | 79(27%) | 39(13%) | 13(4%) | 304 |

**Source: Field data (2021)**

The details for SUA in Table 4.7 show that, more female students (59%) rated their skills for basic computer operations above average compared to males (50%). This presents a 41% and 50% for female and male student respondents who felt their skills below mastery. At UDSM, 56% of female respondents rated their skills above average, equal to their male counterparts. This means 44% for both males and females rated their skills below mastery. A relatively similar experience based on Lim et al. (2020), highlights that, the computer operation skills among university students were skewed in favor of male students over their female counterparts. However, the current findings offer some indicators for an insignificant gap and therefore comparability of over the two groups in both universities. Such evidence in this study builds on Borokhovski et al. (2018) whose

Meta analyses under the Commonwealth of Learning determined the likelihood that, the digital divide between female and male students in terms of technology skills in the context of education has almost closed.

#### 4.2.1.1.1.3 Year of study versus Basic Computer skills

The results for a cross-tabulation conducted to establish the variations of students' basic computer skills with years of study are presented in Table 4.8.

**Table 4.8: Year of Study versus Basic Computer Operation Skills**

| | | *Levels of Basic Computer Operation Skills* | | | | | |
|---|---|---|---|---|---|---|---|
| *Sokoine University of Agriculture* | | Expert | Advanced level | Intermediate level | Novice | Basic Level | Total |
| Year of Study | First Year | 25(22%) | 39(35%) | 33(30%) | 7(6%) | 6(6%) | 110 |
| | Second Year | 35(32%) | 31(28%) | 23(21%) | 12(11%) | 8(10%) | 109 |
| | Third Year | 23(22%) | 24(24%) | 44(43%) | 6(6%) | 5(5%) | 102 |
| Total | | 83(26%) | 94(29%) | 100(31%) | 25(8%) | 19(6%) | 321 |
| | | *Levels of Basic Computer Operation Skills* | | | | | |
| *University of Dar es Salaam* | | Expert | Advanced level | Intermediate level | Novice | Basic Level | Total |
| Year of Study | First Year | 30(30%) | 21(21%) | 32(32%) | 13(13%) | 3(3%) | 99 |
| | Second Year | 24(25%) | 36(37%) | 23(24%) | 12(12%) | 2(2%) | 97 |
| | Third Year | 22(21%) | 37(35%) | 25(24%) | 13(13%) | 7(7%) | 104 |
| | Fourth Year | 4(16%) | 10(42%) | 6(25%) | 3(13%) | 1(4%) | 24 |
| Total | | 80(25%) | 104(32%) | 86(27%) | 41(13%) | 13(4%) | 324 |

Source: Field data (2021)

The details for SUA as presented in Table 4.8 show that, 2nd year students have the largest majority of students (61%) who rated their skills above average, followed by first (58%) and third year (46%). On the other hand, 62% of 2nd year students at UDSM rated their skills above average, followed by 4th year students (58%), 3rd years (57%) and lastly 1st years (52%). The study finds a similarity between the universities in that, 2nd year has largest majority of students with skills above average. This pattern further suggests that, a progression in year of study does not seem to be a determinant for variation in the basic

skills to operate computers. The findings in this study present uncommon impression in relation to the recent literature, like Samani, Noordin and Karimzadeh (2019) and Lim et al. (2021), who observed some consistent progression of technology operation skills with change of year of study. However elsewhere, Ay and Erdem (2020) findings suggest in line with the current study that, such pattern is likely to emerge in contexts where students are exposed to ICT environment which do not consistently support the use of technology.

#### 4.2.1.1.2 Basic Skills for operating Learning Management System (LMS)

This section further interrogated students' general understanding of basics of the Learning Management System (LMS) as primary user on specifically user account, log-in, privacy setting and operating the features for learning. The qualitative data from interview indicate that, students have limited opportunities to interact and master the basic features of LMS. Majority of them possess smartphones and do not have access to connected computers or laptops devices which support the Moodle LMS. One student remarked that:

> *You see we don't use the e-learning system so often; even in cases a lecturer provides materials via the system, only one student can download and the materials are shared through WhatsApp* (Male Second year student-BSc. HN-SUA Feb, 2021).

This is similar to a student at UDSM, who stated that:

> *I hear about the system; I have never been troubled to train about it because there are no serious forces that I should know it because the materials posted on the system are also available in cyber shops* (Female 1st Year student. BSc. Geology-UDSM: March, 2021)

It emerged in the FGD with students pursuing BSc. with Education (Informatics and Mathematics) at SUA and Bachelor of Mass Communication (UDSM) that, the use of

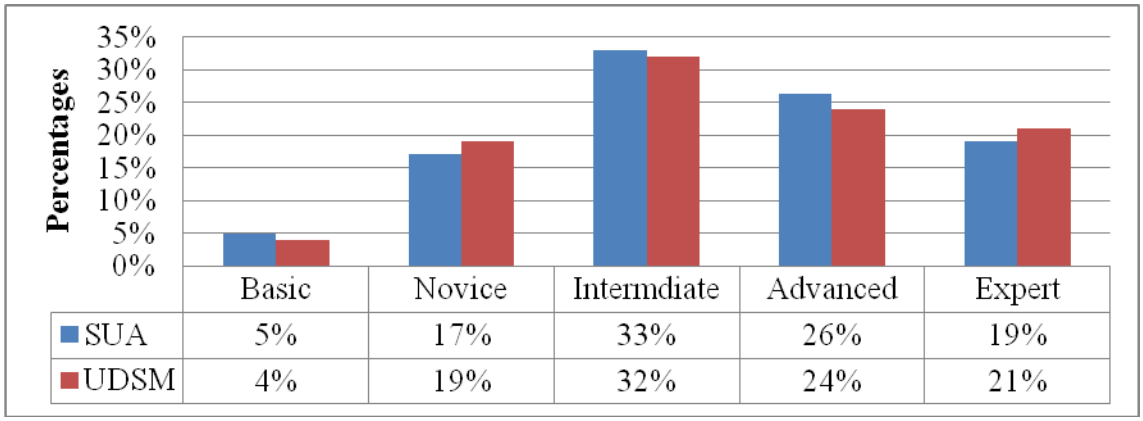
LMS is emphasized in some discussions of their specialization. Such exposure to some uses of the system made them acquire some knowledge on the basic operational features:

> *For us who are doing this programme, have to learn its use because of the specialization as teacher trainees. Even though, the practices of what we learn are limited to only few subjects* (Female, Third Year student BSc. Ed. SUA-Feb, 2021).

Similarly, a student at the UDSM highlighted their capability to operate the system because of popularity of the system with their programme.

> *There is a Diploma programme offered at our school (Mass Communication) which is typically online: The same instructors also teach us: They drive us to master the use of the system and often use it for some activities* (Male 2nd year student-BA. Mass Communication, UDSM: March, 2021).

Questionnaires were further used to interrogate students' basic skills about user account, how to log in, how to do privacy setting and operating the features needed to access the learning tasks through the LMS. The summary of questionnaire-based responses with this regard is presented in Figure 4.3.




| | Basic | Novice | Intermdiate | Advanced | Expert |
|---|---|---|---|---|---|
| SUA | 5% | 17% | 33% | 26% | 19% |
| UDSM | 4% | 19% | 32% | 24% | 21% |

**Figure 4. 3: LMS Operation Skills at SUA and UDSM**

Source: Field data (2021)

The descriptive data for SUA as embedded in Figure 4.3 show that, 107 (33.5%), a largest segment of respondents, have intermediate level of skills. This means they have some theoretical understanding of LMS but still encounter practical challenges to navigate the system. Other 84 (26.3%) respondents with advanced (mastery) skills' level, and 59(18.5%) who rated themselves expert can comfortably navigate the LMS. However, 54 (16.9%) and 15 (4.7%) student respondents rated their skills level as novice and learners respectively. At UDSM, 13 (4%), 61 (18.8%) and 104 (32.1%) students rated their skills as learner, novice and intermediate respectively. Other 78 (24.1%) and 68 (21%) respondents rated their skills at mastery and expert levels respectively. The data pattern presents majority (32.1%) of respondents who rated their skills level intermediate.

Coincidently, cumulative majority, over 55% of respondent students for universities are at learner, novice and intermediate levels, struggling to operate the basic features of university Moodle LMS. This implies that, about 45%, for each of the universities which include advanced and experts can operate the basic LMS features. This also suggests that, they can navigate or learn to navigate further operations for learning via Moodle system. The current findings that majority of students cannot operate the basics of LMS for substantial learning activities in both universities extend the recent observation by Mtebe (2015) for majority of SSA universities. Lessons based on Covid 19 pandemic suggest that, as many universities are making attempts to go virtual by using the available LMSs, there is a high need to confirm if students can use the platforms installed by universities to implement technology supported learning practices.

Further descriptive findings based on cross-tabulation of LMS operation skills against year of study, gender and programme of study are given based on Table 4.9, 4.10 & 4.11.

#### 4.2.1.1.2.1 Year of study versus Basics of the Learning Management System

The results for a cross-tabulation which sought to establish the association of the level of skills to operate LMS and students' year of study are presented in Table 4.9.

**Table 4.9: Year of study versus Skills to operate Learning Management System**

| | | *Levels of Basic Computer Operation Skills* | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Year of Study | First Year | 16(15%) | 34(31%) | 42(38%) | 14(13%) | 4(7%) | 110 |
| | Second Year | 25(23%) | 22(20) | 36(33%) | 18(17%) | 7(6%) | 109 |
| | Third Year | 19(19%) | 28(27%) | 29(28%) | 22(22%) | 4(4%) | 102 |
| Total | | 60(17%) | 84(26%) | 107(33%) | 54(17%) | 15(5%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Year of Study | First Year | 22(22%) | 22(22%) | 35(35%) | 19(19%) | 1(1%) | 99 |
| | Second Year | 26(27%) | 24(25%) | 33(34%) | 11(12%) | 3(3%) | 97 |
| | Third Year | 17(16%) | 26(25%) | 29(28%) | 26(25%) | 6(6%) | 104 |
| | Fourth Year | 3(13%) | 6(25%) | 7(29%) | 5(20%) | 3(13%) | 24 |
| Total | | 68(21%) | 78(24%) | 104(32%) | 61(19%) | 13(4%) | 324 |

Source: Field data (2021)

The class wise data (Table 4.9) shows that, 45% of 1st year students rated their skills above intermediate (advanced and expert), which means they can operate LMS to execute learning tasks. For the 2nd and 3rd years, 43% and 46% of the students rated their skills above average. This means that, the remaining 55% (1st year), 57% (2nd year) and 54% (3rd year) consider their skills below mastery/advanced level (at which one can comfortably operate the LMS). At UDSM, 2nd year class has the largest number (51%) of students with skills to operate LMS features below mastery, followed by 1st year (44%), 3rd year (41%) and fourth year (36%). The data for both universities presents an inconsistent pattern of skills by years of study, where a change/development in LMS operation skills from one class to another is insignificant. This further implies that, a change of class does not guarantee development of the LMS operation skills. However,

this seems to be a surprise; reflective observation by Mtebe (2015) and Ay and Erdem (2020) associate such a possibility with ICT environment that manifests inconsistent support for students' digital literacy for learning.

#### 4.2.1.1.2.2 Gender versus Basics of the Learning Management System

Table 4.10 presents the details based on a cross tabulation which was undertaken to ascertain if the skills for basics of LMS operation are patterned on gender basis.

**Table 4.10**: **Gender *versus* Skills to operate LMS**

| | | ***Levels of the skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Gender | Female | 29(18%) | 50(30%) | 54(33%) | 24(15%) | 6(4%) | 164 |
| | Male | 30(20%) | 32(21%) | 53(35%) | 30(20%) | 8(5%) | 153 |
| Total | | 59(19%) | 82(26%) | 107(33%) | 54(17%) | 14(5%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | |
| Gender | Female | 27(20%) | 36(27%) | 41(30%) | 25(19%) | 6(4%) | 135 |
| | Male | 35(21%) | 38(23%) | 59(35%) | 31(18%) | 6(4%) | 169 |
| Total | | 62(21%) | 74(20%) | 100(32%) | 56(19%) | 12(4%) | 304 |

Source: Field data (2021)

Drawing from Table 4.10, 48% of female respondents at SUA rated their skills to operate LMS above average compared to males (41%). This means, 52% and 59% of females and males have skills below mastery. At UDSM, 47% of female and 43% of male respondents rated their skills above average, that they are likely to operate LMS comfortably. That means, the majorities (53% and 57% of females and males) experience varied difficulties. The study finds closely similar gender patterns of skills to operate LMS between SUA and UDSM, with more female students skilled above average over male respondents. Lim et al. (2020) observed it differently that male students were generally skilled of operating the LMS features more than females. Like the observation by Borokhovski et al. (2018), the female leading position in this study offers some

evidence based in Tanzanian context that the digital divide in terms of gender which has ever since existed in education is tightening or closing. This indicates some corresponding trends which contribute substantially to shaping the attitudes and skills of female students towards ICT use for learning.

#### 4.2.1.1.2.3 Programme of study versus Basics of the Learning Management System

Table 4.11 presents the details based on a cross tabulation undertaken to ascertain if the skills for basics of LMS operation are patterned with programmes of study.

**Table 4.11: Study Programme versus Skills to operate Learning Management System**

| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
|---|---|---|---|---|---|---|---|
| Programme | BSc. AEA | 19(42%) | 9(20%) | 14(31%) | 3(6%) | 0(0%) | 45 |
| | BSc. AnHP | 6(13%) | 9(20%) | 21(47%) | 6(13%) | 4(9%) | 46 |
| | BSc. BIRM | 8(20%) | 8(20%) | 13(32%) | 9(22%) | 3(7%) | 41 |
| | BRD | 1(2%) | 19(43%) | 17(39%) | 6(14%) | 1(2%) | 44 |
| | BSc Forestry | 11(23%) | 14(29%) | 12(25%) | 11(23%) | 3(6%) | 48 |
| | BSc. HN | 7(15%) | 16(33%) | 16(33%) | 6(13%) | 3(6%) | 48 |
| | BSc. Ed | 8(17%) | 9(20%) | 14(30%) | 13(28%) | 1(2%) | 46 |
| Total | | 60(19%) | 84(26%) | 107(33%) | 54(17%) | 15(5%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Programme | BA. DS | 12(38%) | 10(31%) | 8(25%) | 2(6%) | 0(0%) | 32 |
| | BAED | 2(7%) | 7(23%) | 12(39%) | 10(32%) | 0-0 | 31 |
| | BAMC | 5(16%) | 5(16%) | 13(42%) | 7(23%) | 1(3%) | 31 |
| | BCA | 2(6%) | 9(28%) | 16(50%) | 5(17%) | 0(0%) | 32 |
| | BLIS | 4(13%) | 4(13%) | 14(45%) | 7(23%) | 2(6%) | 31 |
| | BSc. ANREB | 4(13%) | 9(28%) | 7(22%) | 7(22%) | 5(16%) | 32 |
| | BSc. Civ. Eng | 8(22%) | 9(24%) | 12(32%) | 6(16%) | 2(5%) | 37 |
| | BSc. in Geology | 10(36%) | 5(18%) | 5(18%) | 7(25%) | 1(4%) | 28 |
| | LLB | 3(7%) | 3(7%) | 16(39%) | 10(24%) | 9(22%) | 41 |
| | PESS | 8(28%) | 4(14%) | 8(28%) | 7(24%) | 2(6%) | 29 |
| Total | | 58(18%) | 78(24%) | 109(34%) | 66(20%) | 22(7%) | 324 |

Source: Field data (2021)

Based on data in Table 4.11, BSc. AEA programme has a larger number of students (64%) who rated their skills above average/intermediate, followed by BSc. Forestry (52%), BSc. HN (48%) and BRD (45%). The programmes whose largest numbers of

students have skills below mastery include BSc. AnHP (67%), BSc. Ed (61%) and BIRM (61%) respectively. At UDSM, larger numbers of students in LLB (85%), BA-LIS (75%), BA-ED (71%), BA MasCom (68%) and BCA (66%) and BSc. Civ. Eng (54%) rated their skills below mastery, such that, they are either at basic, novice or intermediate. The programmes whose majority of students (at least 50%) rated their skills to operate LMS above average are BA DS (69%) and BSc in Geology (54%). The comparative pattern presents an impression that, large segment of students at SUA (45%) rated their skills above average compared to the segment of students at UDSM (42%).

While the pattern seem to indicate more initiatives to support programme level students' use of LMS at SUA over UDSM, the variations between programmes within the university cases indicate a divide. Congruent to Samani, Noordin and Karimzadeh (2019) study on Iranian Universities, the current study indicates that, instructors for some programmes are likely to be orienting their students to navigate the LMS more than others. The study further finds that, the pattern based on clusters like science, engineering, humanities and arts (for example at UDSM) do not seem to favor science disciplines, which are naturally expected to be advantaged (Samani et al., 2019). The findings raise skepticism that students in programmes including those of science nature may be not ready to use LMSs as tools for learning in situations like Covid 19 pandemic era. The current findings extend the evidence by Mtebe, Fulgence and Gallagher (2021) that, the technology use practices at SUA and UDSM have not been institutionalized sustainably.

#### 4.2.1.1.2 Informational Literacy Skills at SUA and UDSM

Informational skills define one's abilities to identify and search for information, create contents, manage, evaluate and share information and observe ethics in writing (UNESCO-IS, 2018). Evidence from Elmunsyah, Hidayat & Patmantara (2018) confirm that, students with desirable level of information literacy skills can sort and select information that suits learning needs, and distinguish from hoax information. In other words, such student can access, validate, assess and verify the information to guarantee optimal learning. The study interrogated a total of five competency areas of informational digital literacy skills for a student. The aspects are borrowed from the UNESCO Digital Literacy Skills' Framework (UNESCO-IS, 2018) and the Eisenberg and Berkowitz's *Big 6 Information Skills Model (1990),* both of which have some obvious relevance in the context of selected Tanzanian Universities.

Students were asked to rate their current level of skills for the identified competency areas based on 5 (five) points Likert scale items, where point 1 represents basic level (for a learner), 2 for novice (with limited knowledge; 3 for intermediate (with limited practical application; 4 for advanced level (mastery) and 5 for experts (professionals). The summary of responses is presented in Table 4.12a for SUA and 4.12b for UDSM and the findings for each aspect of informational literacy skill given in the sections below.

**Table 4.12a Students' level of Informational Literacy Skills at SUA (N=321)**

| Digital Literacy skills aspects | Levels of Digital literacy skills | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1-Basic (Learner)* | | *2-Novice* | | *3-Intermediate* | | *4-Advanced (Mastery)* | | *5-Expert (Professional)* | |
| | *Freq.* | *%* | *Freq.* | *%* | *Freq.* | *%* | *Freq.* | *%* | *Freq.* | *%* |
| Search and filter information | 18 | 6% | 43 | 13% | 119 | 37% | 111 | 35% | 30 | 10% |
| Evaluate Information | 27 | 8.4% | 41 | 12.8% | 98 | 30.5% | 99 | 30.8% | 56 | 17.4% |
| Communicate information and collaborate on line | 18 | 5.6% | 36 | 11.3% | 94 | 29.4% | 98 | 30.6% | 74 | 23% |
| Create and use digital information ethically | 24 | 7.5% | 37 | 11.5% | 101 | 31.5% | 96 | 29.9% | 63 | 19.6% |
| Protect personal data and privacy | 35 | 10.9% | 44 | 13.7% | 122 | 38% | 95 | 29.6% | 25 | 7.8% |

**Source: Field data-SUA (2021)**

**Table 4.13b Students' Level of Informational Literacy Skills at UDSM (N=324)**

| Digital Literacy skills aspects | Levels of Digital literacy skills | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *1-Basic (Learner)* | | *2-Novice* | | *3-Intermediate* | | *4-Advanced (Mastery)* | | *5-Expert (Professional)* | |
| | *Freq.* | *%* | *Freq.* | *%* | *Freq.* | *%* | *Freq.* | *%* | *Freq.* | *%* |
| Search and filter information | 7 | 2.2% | 55 | 17% | 89 | 27.5% | 106 | 32.7% | 60 | 20.7% |
| Evaluate Information | 12 | 4% | 51 | 15.7% | 98 | 30.2% | 93 | 28.7% | 69 | 21.3% |
| Communicate information and collaborate on line | 11 | 3.4% | 47 | 14.5% | 68 | 21% | 106 | 32.7% | 92 | 28.4% |
| Create and use digital information ethically | 16 | 4.9% | 70 | 21.6% | 94 | 29% | 81 | 25% | 63 | 19.4% |
| Protect personal data and privacy | 21 | 6.5% | 45 | 13.9% | 101 | 31.3% | 87 | 26.9% | 69 | 21.4% |

**Source: Field data-UDSM (2021)**

#### 4.2.1.1.2 Skills to Search and Filter Information and Digital Contents

This section presents the findings based on Table 4.12a and 4.12b. The ability to search and filter information relates to how one identifies information/material needs, uses up-to-date search strategies for the digital materials and tailors them rightly to learning tasks. Eisenberg and Berkowitz (1990) view that, students' capacity to reflect on the type of information needed will help them move more efficiently towards solutions. The current study required the student respondents to rate themselves against the skills' aspect. The qualitative data based on FGDs with student groups at SUA reveals that, the university Library (SNAL) staff offers voluntary training on information literacy for interested graduate and undergraduate students. Like SUA, the UDSM Library services unit also provides short courses tailored to challenges with informational literacy on arrangements with groups of students. Students who attended such training expressed some confidence with regard to strategies for electronic information search:

> *It requires one to learn and practice; for those who chose to be serious can tell you the course is helpful; it helps you to be efficient in searching and selecting appropriate material* (Female 2nd year student-Mass Communication-UDSM: March, 2021)

> *I have attended several group and one-to-one trainings with library staff who normally help students to master library use techniques; the trainings helped me as I can use search strategies to access relevant materials for my studies* (Male 3rd Year-BSc. Agriculture Economics & Agribusiness-SUA: Feb, 2021).

The qualitative data further revealed that, some students are aware of the available trainings on library use and informational literacy in particular but never took any initiatives to attend because of negligence and lack of awareness on the usefulness of such trainings. Such kind of students would even rate themselves skilled enough. "*I read about the trainings on notice board; but as longer as I use Google every day to write my*

*assignments correct, I thought that's all!"* (Female 3rd Year-BSc. Animal Science, SUA. Feb, 20121)

The descriptive data for SUA on Table 4.12a presents 18 (5.6%) respondents who rated their level of the skills as learners and 43 (13%) as novice. Up to 119 (37.2%) rated their skills at intermediate level; 111 (35%) advanced level and 30 (9.6%) as experts. At UDSM (Table 4.7b), 7(2.2%), 55(17%) and 89(27.5%) students are learners, novice and intermediate respectively. Other 106 (32.7%) and 60 (20.7%) students rated their skills advanced and expert level respectively. Generally compared, 55.6% and 53.4% student for SUA and UDSM respectively, rated their skills level between basic and intermediate. This means they struggle to use search strategies for materials from digital sources and tailor them to current learning tasks. However, 141 (44.4%) student respondents for SUA and about 47 % for UDSM rated themselves to some higher levels, which implies that, they can identify information/material needs, uses up-to-date search strategies for the digital materials and tailors them rightly to learning tasks. The findings are not unique to Tanzanian context: Bhatt and MacKenzie (2018) observed similarly in Northern Ireland that, students trusted the search results based on popularity and relevance to assignments but not credibility. This extends Mungwabi's (2019) observation at UDSM, where majority of undergraduate students had deficiencies to use up-to-date search strategies and to tailor materials rightly to learning tasks.

Further cross tabulation results to establish the pattern on Skills to Search and filter information and digital contents with year of study, gender and programme of study are presented in Tables 4.13, 4.14 and 4.15 respectively.

#### 4.2.1.1.2.1 Year of study versus Skills to Search and Filter Digital Information

Table 4.13 presents the details based on a cross tabulation which was undertaken to ascertain if the skills for basics of LMS operation are patterned with year of study.

**Table 4. 14: Year of Study versus Skills to Search and Filter Digital Information**

| | | ***Levels of the Skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate | Novice | Basic Level | Total |
| Year of Study | First Year | 15(13%) | 36(33%) | 41(37%) | 15(14%) | 3(3%) | 110 |
| | Second Year | 18(17%) | 40(37%) | 28(26%) | 17(16%) | 6(6%) | 109 |
| | Third Year | 16(16%) | 35(34%) | 30(29%) | 12(12%) | 9(9%) | 102 |
| Total | | 49(15%) | 111(35%) | 99(31%) | 44(14%) | 18(6%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate | Novice | Basic level | Total |
| Year of Study | First Year | 20(20%) | 30(30%) | 28(28%) | 20(20%) | 1(1%) | 99 |
| | Fourth Year | 1(4%) | 7(29%) | 9(38%) | 6(25%) | 1(4%) | 24 |
| | Second Year | 24(25%) | 29(30%) | 27(28%) | 15(15%) | 2(2%) | 97 |
| | Third Year | 18(17%) | 46(44%) | 26(25%) | 13(13%) | 1(0%) | 104 |
| Total | | 63(19%) | 112(35%) | 90(28%) | 54(17%) | 5(2%) | 324 |

Source: Field data (2021)

The data in Table 4.13 presents that, a total of 51 (46%) first year students at SUA rated their skills to search and filter information as above average. The highest percent (53%) second year students rated their skills above average, followed by 51(50%) third year students. The pattern where 46%, 53% and 50% for 1st, 2nd and 3rd years rate their skills above average hardly determines any change/development of information searching and filtering skills from one year (class) to another. For UDSM, 50(51%), 53(55%), 64(62%) and 8(33%) students in 1st, 2nd, 3rd and 4th years respectively, rated their skills to search and filter information above average. Unlike SUA, the pattern at UDSM defines some developments from one year to another especially from first to third year classes. However, fewer fourth year students are at this level, which implies that, some changes

may have occurred, such that the newer cohorts increasingly value the use of online resources than the past.

#### 4.2.1.1.2.2 Gender versus Skills to Search and Filter Information

Table 4.14 presents the details based on a cross tabulation which was undertaken to ascertain if the skills for basics of LMS operation are patterned with gender.

**Table 4.14: Gender versus Skills to Search and Filter Information**

| | | *Levels of the skills* | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate | Novice | Basic level | Total |
| Gender | Female | 26(16%) | 54(33%) | 53(32%) | 24(15%) | 7(4%) | 164 |
| | Male | 22(14%) | 55(36%) | 46(30%) | 20(13%) | 10(7%) | 153 |
| Total | | 48(15%) | 109(35%) | 99(31%) | 44(14%) | 17(6%) | 317 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate | Novice | Basic level | |
| Gender | Female | 25(19%) | 48(36%) | 35(26%) | 24(18%) | 3(2%) | 135 |
| | Male | 32(19%) | 61(36%) | 49(29%) | 25(15%) | 2(1%) | 169 |
| Total | | 57(19%) | 109(35%) | 84(28%) | 49(17%) | 5(1%) | 304 |

Source: Field data (2021)

The cross-tabulation results in Table 4.14 present a larger number of females constituting a group of students rated their skills at expert level (53%), slightly above the number of males (49%). The findings imply that, despite the leading position for the females, the findings on information search skills at SUA do not clearly differ with gender. At UDSM, majority of males (55%) rated their skills to search and filter digital information slightly above the female respondents who rated themselves at the same level (54%). Like SUA, the data at UDSM leaves room for some reasoning that, the pattern of the skills is not gender based because both males and females have relatively equal segments distributed to the levels. A study by Zhang, Wang and Liu (2021) found that, female students with plenty of support matched the skills level with male students in these skills. Besides, however in a different test, female students from multi-child families still encountered

difficulties to search and filter information compared to men. In a view of this, males and females students in the two universities are generally comparable in terms of their information searching and filtering skills (Borokhovski et al., 2018)

#### 4.2.1.1.2.3 Programme of Study versus Skills to Search and Filter Information

Table 4.16 presents the details based on a cross tabulation which was undertaken to ascertain if the skills for basics of LMS operation are patterned with programme of study.

**Table 4.16: Programme of study versus Skills to search and filter information**

| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate | Basic level | Novice | Total |
|---|---|---|---|---|---|---|---|
| Programme | BSc. AEA | 6(13%) | 21(47%) | 12(27%) | 3(7%) | 3(6%) | 45 |
| | BSc. AnHP | 6(13%) | 10(22%) | 17(37%) | 3(7%) | 10(21%) | 46 |
| | BIRM | 6(15%) | 14(34%) | 9(22%) | 5(12%) | 7(17%) | 41 |
| | BRD | 2(5%) | 21(48%) | 19(43%) | 0(0%) | 2(4%) | 44 |
| | BSc Forestry | 12(25%) | 14(29%) | 13(27%) | 2(4%) | 7(15%) | 48 |
| | BSc. HN | 10(21%) | 19(40%) | 12(25%) | 2(4%) | 5(10%) | 48 |
| | BSc. Ed | 7(15%) | 12(26%) | 14(30%) | 3(7%) | 10(22%) | 46 |
| Total | | 49(15%) | 111(35%) | 99(31%) | 18(6%) | 44(14%) | 321 |

| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate | Novice | Basic level | |
|---|---|---|---|---|---|---|---|
| Programme | BA. DS | 13(41%) | 9(28%) | 9(28%) | 1(3%) | 0(0%) | 32 |
| | BA. ED | 2(6%) | 3(10%) | 13(42%) | 12(38%) | 1(3%) | 31 |
| | BA. MasCom | 5(16%) | 11(35%) | 8(26%) | 6(19%) | 1(3%) | 31 |
| | BCA | 2(6%) | 13(41%) | 11(34%) | 6(19%) | 0(0%) | 32 |
| | BA. LIS | 3(10%) | 14(45%) | 9(29%) | 4(13%) | 1(3%) | 31 |
| | BSc. ANREB | 2(6%) | 11(34%) | 9(28%) | 9(28%) | 1(3%) | 32 |
| | BSc. Civ. Eng. | 3(8%) | 19(51%) | 7(19%) | 7(19%) | 1(3%) | 37 |
| | GEOLOGY | 9(32%) | 6(21%) | 10(36%) | 3(11%) | 0(0%) | 28 |
| | LLB | 9(22%) | 15(37%) | 16(39%) | 1(2%) | 0(0%) | 41 |
| | PESS | 8(28%) | 11(38%) | 5(17%) | 5(17%) | 0(0%) | 29 |
| Total | | 63(19%) | 112(35%) | 90(27%) | 54(17%) | 5(1%) | 324 |

Source: Field data (2021)

The details in Table 4.16 present four (4) programmes at SUA, whose majority of students rated their skills above average; These are BSc. AEA (60%) and BSc. HN (60%), followed by BSc. Forestry (54%) and BRD (52%). Other programmes have majority of students who rated their skills below mastery, which implies limited skills, namely, BSc. AnHP (65%), BIRM (51%) and BSc. Ed (59%). The findings at UDSM

present a relatively similar impression, such that, certain programmes have larger numbers of students with skills above average. More students in such programmes can search and filter information required for the learning tasks than in other programmes. The programmes with majority of students with skills above average include BA-DS (69%), BSc. Civ Eng. (59%), LLB (59%), BA LIS (55%) and BSc. Geology (54%). Other programmes have majority of students with limited skills to search and filter information based on online sources; these include BA. ED (84%), BSc. ANREB (59%) and BCA (53%). This is not a surprise based on earlier indicators that instructors in some programmes provide some support, unlike other. This is congruent to the observation by Ay and Erdem (2020), who confirmed the skills level for online information search strategies which were patterned in favor of some programmes whose instructors posed strict requirements for students to do online information search for learning tasks, irrespective of the nature of the programme.

#### 4.2.1.1.3 Skills to Evaluate Digital Information and Contents

Scholars agree that, the diversity of information in ICT environment requires both educators and students to be selective of the learning materials relevant to learning tasks (Bendersky et al., 2012). With such skills, a student can analyse, interpret, compare, and critically evaluate the credibility and reliability of digital information and contents in order to make use on appropriate tasks. Risks associated with a lack of such skills include misinformation and misconceptions (Breakstone et al., 2019). Students were asked to rate their perceived level of skills with regard to this area of competence.

The qualitative data based on FGDs with students at study cases indicate that, students see plenty materials as potentials to their learning task but struggle to find connections with instructors' desired learning outcomes: They however struggle to make choice of credible materials and contents to use in their learning tasks: *"I normally strive to find online resources for my courses; there is situation, however, where some materials online are not in line with the instructor's approaches and solutions to the question"* (Male 3rd year BSc. Civil Engineering-UDSM. March, 2021)

Further data also indicated that, students' attempt to evaluate the relevance and credibility of materials is limited to what the search results offer. It emerged repeatedly that, students lack search strategies to access relevant materials to their learning tasks: "*Every time I re-phrase the search topic I get relatively similar results! You spend a lot of time to get the different results!"* (Male 1st Year Student, Bachelor of Rural Development-SUA. February, 2021). *"I remember my lecturer dismissed my assignment because I had used materials from a personal blog source*" (3rd Year female student, BSc. Human Nutrition-SUA. February, 2021).

The descriptive data from SUA presented in Table 4.12a indicate that, 27 (8.4%) students rated their skills as learners, 41(12.8%) as novice and 98(30.5%) rated their skills at intermediate level. The data also show 99(30.8%) and 56(17.4%) students rated their skills advanced and expert levels respectively. At UDSM (4.12b), 13(4%), 51(15.7%) and 98(30.2%) students rated their skills basic, novice and intermediate respectively. Other 93(28.7%) and 69(21.3%) students rated their level of skills advanced and expert respectively. The comparative impression between the two universities shows that, 50% of respondents at UDSM and 51.7% at SUA possess skills

level between basic and intermediate. They are not confident with their ability to analyse, interpret, compare, and critically evaluate the credibility and reliability of digital information and contents in relation to the learning tasks at hand. Otherwise, 50% of respondents at UDSM and 48.3% others at SUA have skills between advanced and expert which suggest that they have some confidence to evaluate digital information and contents suitable for learning. Despite the small margin between respondents with and without confidence of their skills to evaluate digital information in both universities, the study finds a substantially large number of students who must be supported to learn with ICTs. Based on Breakstone et al. (2019), students who cannot analyse, interpret, compare, and critically evaluate the credibility and reliability of digital information and contents are at a risk of misinformation and misconceptions.

The study further cross-tabulated the data in order confirm the pattern of skills to evaluate digital information and contents with year of study, gender and programme of study. The respective findings are presented in Tables 4.17, 4.18 and 4.19.

#### 4.2.1.1.3.1 Year of Study versus Skills to Evaluate Digital Information

A cross-tabulation was carried out in order to determine the pattern of students' skills to evaluate digital information with year of study, whose summary of findings appears in Table 4.17

**Table 4.17: Year of study versus skills to Evaluate Digital Information**

| *Sokoine University of Agriculture* | | Expert | Advanced level | Intermediate level | Basic level | Novice | Total |
|---|---|---|---|---|---|---|---|
| Year of Study | First Year | 20(18%) | 30(27%) | 42(38%) | 8(7%) | 10(9%) | 110 |
| | Second Year | 21(19%) | 32(29%) | 27(25%) | 8(7%) | 21(19%) | 109 |
| | Third Year | 14(14%) | 38(37%) | 30(29%) | 11(11%) | 9(9%) | 102 |
| Total | | 55(17%) | 100(31%) | 99(31%) | 27(8%) | 40(12%) | 321 |
| *University of Dar es Salaam* | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Year of Study | First Year | 24(24%) | 31(31%) | 20(20%) | 20(20%) | 4(4%) | 99 |
| | Fourth Year | 1(4%) | 5(21%) | 11(46%) | 7(29%) | 0(0%) | 24 |
| | Second Year | 27(28%) | 24(25%) | 30(31%) | 10(10%) | 6(6%) | 97 |
| | Third Year | 18(17%) | 32(31%) | 37(36%) | 15(14%) | 2(2%) | 104 |
| Total | | 70(22%) | 92(28%) | 98(30%) | 52(16%) | 12(4%) | 324 |

Source: Field data (2021)

SUA data on students' skills about information evaluation by years of study show that, 3rd year class has the largest number (51%) of students with skills above average, followed by 2nd year and 1st year classes (48% and 45%) respectively. On the other hand, 1st year class has the largest number of students with the skills below mastery (55%), followed by 3rd year (51%) and 3rd year (49%). The impression provides a marginal difference between the students of different years of study, which, however, does not offer significant evidence for development of digital literacy as one goes to a higher class. A different pattern for UDSM shows that, 56%, 54%, 48% and 25% of students for 1st, 2nd, 3rd and 4th years respectively rated their skills to evaluate digital information above average. This implies that, the skills to evaluate digital information for learning are skewed to lower classes.

The current findings reflect the reviewed studies, such as Tylor and Dalal (2017); Zhang, Wang and Liu (2021); Samani et al. (2019); and Lim et al. (2021). The consensus has been that, progression to a further year of study manifest development of skills to mount strategies to evaluate information. However, the justification for the

deviation may be the fact that, such skills at the universities are not consistent part and parcel of what transpire across the academic life of a student. In a view of UNESCO-IS (2018), Blum (2019) and Kajee and Balfour (2011), students who transit through such experience are likely to graduate without substantial skills to integrate the learned materials to the relevant contexts.

#### 4.2.1.1.3.2 Programme of Study versus Skills to Evaluate Digital Information

A cross-tabulation was carried out in order to determine the pattern of students' skills to evaluate digital information with programme of study, whose summary of findings appears in Table 4.18.

**Table 4.18: Programme of study versus Skills to evaluate digital information**

| | | ***Levels of the skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| *Sokoine University of Agriculture* | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Programme | BSc. AEA | 10(22%) | 14(31%) | 16(36%) | 4(9%) | 1(2%) | 45 |
| | BSc. AnHP | 3(7%) | 16(35%) | 14(30%) | 7(15%) | 6(13%) | 46 |
| | BIRM | 8(20%) | 12(29%) | 10(24%) | 9(22%) | 2(5%) | 41 |
| | BRD | 2(5%) | 23(52%) | 16(36%) | 2(5%) | 1(2%) | 44 |
| | BSc FORESTRY | 12(27%) | 13(30%) | 13(30%) | 7(20%) | 3(7%) | 48 |
| | BSc. HN | 10(21%) | 13(27%) | 15(31%) | 5(10%) | 5(10%) | 48 |
| | BSc. Ed | 10(22%) | 9(20%) | 12(26%) | 6(13%) | 9(20%) | 46 |
| Total | | 55(17%) | 100(31%) | 99(31%) | 40(12%) | 27(8%) | 321 |
| *University of Dar es Salaam* | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Programme | BA. DS | 12(36%) | 13(40%) | 4(13%) | 3(9%) | 0(0%) | 32 |
| | BA. ED | 3(10%) | 3(10%) | 11(35%) | 13(42%) | 1(3%) | 31 |
| | BA. MC | 4(13%) | 8(26%) | 12(39%) | 3(10%) | 4(13%) | 31 |
| | BCA | 3(9%) | 11(34%) | 13(40%) | 3(9%) | 2(6%) | 32 |
| | BA. LIS | 5(16%) | 5(16%) | 13(42%) | 7(23%) | 1(3%) | 31 |
| | BSc. ANREB | 0(0%) | 16(50%) | 9(28%) | 6(19%) | 1(3%) | 32 |
| | BSc. Civ. Eng | 5(14%) | 12(32%) | 12(32%) | 7(19%) | 1(3%) | 37 |
| | BSc. Geology | 12(43%) | 4(14%) | 8(29%) | 3(11%) | 1(4%) | 28 |
| | LLB | 8(20%) | 11(27%) | 17(41%) | 5(12%) | 0(0%) | 41 |
| | PESS | 9(31%) | 9(31%) | 8(26%) | 2(7%) | 1(3%) | 29 |
| Total | | 70(22%) | 92(28%) | 98(30%) | 52(16%) | 12(4%) | 324 |

Source: Field data (2021)

The data for SUA in Table 4.18 shows that, less than half of the programmes have larger numbers of students with skills above average/intermediate, namely, AEA (53%), BRD

(57%), and BSc Forestry (57%). On the other end, more programmes reflect larger number of students with skills below mastery, including BSc. Ed (57%), BSc. HN (52%), BIRM (51%); BSc. AnHP (58%). At UDSM, the programmes with majority of students with skills to evaluate information above average include BA-DS (78%), BA-PESS (62%), BSc. Geology (57%) and BSc. ANREB (50%). Over 60% of the programmes at UDSM have majority of students who rated their skills to evaluate information below mastery. The impression shows that, more programmes (including science nature) have majorities of students with limited skills to evaluate digital information. This connects to Commission on Science and Technology for Development (2018) view that, mastery of ICT literacies specific to specialization does not necessarily guarantee literacies for learning. This is similar to observation by Ay and Erdem (2020), as both UDSM and SUA had instructors who advocate for students' informational literacy.

#### 4.2.1.1.3.3 Gender versus skills to evaluate digital information

A cross-tabulation was carried out in order to determine the pattern of students' skills to evaluate digital information with programme of study, whose summary of findings appears in Table 4.19.

**Table 4.19: Gender versus skills to evaluate digital information**

| | | ***Levels of skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Gender | Female | 28(17%) | 48(29%) | 59(36%) | 17(10%) | 12(7%) | 164 |
| | Male | 25(16%) | 51(33%) | 40(26%) | 22(14%) | 15(10%) | 153 |
| Total | | 53(17%) | 99(31%) | 99(31%) | 39(12%) | 27(8%) | 317 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Gender | Female | 30(22%) | 43(32%) | 31(23%) | 24(18%) | 7(5%) | 135 |
| | Male | 31(18%) | 46(27%) | 63(37%) | 25(15%) | 4(2%) | 169 |
| Total | | 61(22%) | 89(28%) | 94(30%) | 49(16%) | 11(4%) | 304 |

Source: Field data (2021)

The data from SUA (Table 4.19) show that, 46% of females have skills above average compared to 49% of males. In other words, larger part (54%) of female population has skills below mastery compared to males (51%). Despite the difference between the two groups (males and females), the variation do not seem to suffice a claim for a significant gender based pattern in this competence area. As such, the two groups are indifferent with regard to the type of skills. Otherwise, 54% of female respondents at UDSM rated their skills to evaluate digital information above average, compared to 46% of males.

Elsewhere, Taylor and Dalal (2017) confirmed gender based pattern of information evaluation literacy skills, where female respondents discerned more than males in terms of the skills to evaluate Internet sources. Females were more likely to use critical evaluation criteria like understanding of a site, verification of the information on site, and the scrutiny of the credentials of the author; currency of a site and the quality of the writing/material layout on the site. However, males emerged more confident in scrutinizing the credibility and accuracy of the search results from search engines. The impression based on the discussion suggests that, ICT is a tool under which, both male and female students have equal room to learn authentically.

#### 4.2.1.1.4 Skills for Communication and Collaboration Online

The use of technologies gives room for efficient and flexible collaborative interaction between learners. The study sought to elicit students' own perception of their skills to use at least one of the technologies observed in the context of studied university, namely, email, dropbox and Learning Management System to interact, collaborate, share data and information with others for construction and co-creation of resources and

knowledge. The qualitative data for this competence area show that, less often students use Moodle as a platform for collaborative learning. As such, majority of students have less confidence with their ability to use the system for features other than downloading handouts/reading materials and assignments:

> *Many teachers who teach us use LMS. Features used more often are mainly sharing of lecture notes and other reading materials. Of course many students do not take the use of the system serious and are therefore not conversant with many features* (Male 3rd Year student: BSc. Geology. UDSM: March, 2021).

The clamor is also reiterated by another student from SUA, who stated that:

> *No collaborative learning takes place via e-learning platform (Moodle). Am not sure most of us understand its comprehensive use because for us students communication is mainly through WhatsApp (Male 2nd year student-BSc. Forestry-SUA. February, 2021)*

The qualitative data based on interview with ICT technical team at SUA have shown a skewed number of hits to subjects provided for BSc. in Education. Hits mean the attempts to access subjects in the Moodle LMS. The larger number of hits suggests a higher level of awareness about the operations of the system and the vice versa. The programme registered a larger number of hits on subjects which had contents, indicating that students under this programme utilize the system and therefore some literacy level. As the use discerns to some programmes, that also indicates that students of certain programmes have relatively higher skills' level over other programmes:

> *Teachers and students for Bachelor of Science, Education in Mathematics and Informatics mostly use the system; students of this programme are the ones who consult us mostly on ways to use the system on some functions including collaborative discussion* (Female ICT technical team member-SUA. February, 2021).

Similarly, some indicators at UDSM suggest a situation where, instructors and students of certain programmes use the LMS relatively more often than others. This also

suggests a likelihood that students in such programmes have higher level of skills to communicate and collaborate through the system. Like SUA, students' understanding of the system use form communication and collaborative works at UDSM is instructor-motivated. This further means that, students' mastery of the platform depends on instructors' commitment to use the system. For example, at UDSM, some instructors are popular users of some comprehensive features than others*:*

> *Prof. XYL (from the College of ICT) and Dr. Abc (from College of Natural Sciences) have everything in the system. They carry out discussions, quizzes and Tests via the system: As such, their students are also used to the system because we have not had any cases reported* (KI 1, CVL-UDSM: March, 2021)

Qualitative data for both SUA and UDSM with regard to the use of email show that, majority of students expressed their ability to use emails for communication with instructors and class groups. Students used email communication with instructors on aspects like sharing of assignments and feedbacks. Emails are also used to communicate announcements to groups of students. Despite its popularity for instructor-student-instructor interaction and collaborative functions, however, instructors have opinions which indicate that majority of students cannot write emails appropriately. The view is based on the following recurrent opinions of instructors:

> *Pertinent issues with emails majority of my students display include failure to write subject; the whole email body placed as a subject; Lack of continuity, as every reply email is written as a new thread; majority of students, many times don't write salutation* (Male Instructor, School of Law-UDSM. March, 2021)

> *Our students can't write good emails: A student can resend the same email, over and over again! Many of them write incomplete email, and many times do not respond on time* (Female Instructor, Veterinary Medicine-SUA. February, 2021)

> *Students can't structure good emails and most of them don't have a tendency to read emails regularly. I have even heard many say they have*

> *forgotten their email account details. So you can send information via email but you don't receive feedback because this is not something they are punctual with; they prefer and are good with WhatsApp communication* (Female Instructor, College of Agricultural Sciences & Fisheries Technology (COAF)-UDSM. March, 2021)

The researcher further confirmed some communication and collaborative tools which are popular among instructors at the study cases but however unpopular to students. The study interrogated students' awareness and skills to use dropbox and Google drive for collaborative work with instructors and peers. The students' responses confirmed that, students are illiterate of such system. All the students who participated in the FGDs had never declared their illiteracy on the tools. This shows that, students have limited platforms for collaborative works and that; they need to be introduced and be trained to use such technology tools.

The descriptive data for SUA (Table 4.12a) show that, 18(5.6%) students rated their skills as learners, 36(11.3%) as novice and 94(29.4%) are at intermediate level. This makes a total of 148(46.2%) students who perceive some deficiencies in this competency area and therefore are challenged to use the available technologies to communicate, interact to create and share knowledge and learning tasks. However, 98(30.6%) and 74(23.1%) students who rated their skills advanced and expert are likely to be able to use the technology opportunities, when other factors are constant. On the same aspect, the descriptive data for UDSM (Table 4.12b) show that, 11(3.4%), 47(14.5%) and 68(21%) perceive their skills as learners, novice and intermediate level respectively. Up to 106(32.7%) and 92(28.4%) respondents rated their skills advanced and expert respectively.

The study conceives the following perspectives based on the data: Although the descriptive data indicate majority of students demonstrated higher level of skills to use

ICT platforms for collaborative learning such as emails and Moodle LMS, the qualitative data suggests students rating may be exaggerated. The dominant modes of communication and collaborative work is email and face-to-face. Furthermore, whereas the use of Moodle system is still practically unpopular, students expressly indicate confidence and ability to use emails for communication. However, qualitative evidence based on FGDs with students and interview with instructors provide a picture that majority of students still write emails with weaknesses.

The study has further shown that, different tools for communication and collaboration are used by students to communicate among themselves and with their instructors. Unfortunately, the use of such tools lacks appropriate framework to ensure consistency. Based on Castro (2019), Moodle LMS use in the selected universities is at basic level; where it acts as repositories of contents for download. Otherwise, an intermediate level is a more interactive communication and knowledge-sharing platform. The ideal, a higher level use is adaptive functionalities of the platform.

The other tools observed include email and WhatsApp social network. Although students perceive themselves skilled in using such tools, their uses are not academically comprehensive because they manifest a lot of irregularities. A different experience based on McKnight et al. (2016), the use of tools helped to provide efficiencies for educators and learners, making daily routines like checking and grading homework quicker and easier. One is able to experience the use of the ICTs routinely including advanced use of learning resources and content, igniting cognitive processes that enhance learning. Some work is therefore required to mentor students' appropriate

ways to communicate and collaborate by using these technologies to achieve the targets of learning tasks.

The study cross-tabulated the data in order confirm the pattern of skills to communicate and collaborate online in relation to programme of study, year of study and gender. The respective findings are presented in Tables 4.19, 4.20 and 4.21.

#### *4.2.1.1.4.1 Study Programme* versus *Skills for communication and collaboration online*

The study carried out a cross-tabulation to explore the pattern of skills to communicate and collaborate online in relation with programme of study. The summary of findings is presented in Table 4.19.

**Table 4.19: Programme of study versus Skills to Communicate and Collaborate Online**

| | | ***Levels of the Skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Mastery | Intermediate level | Novice | Basic | Total |
| Programm | BSc. AEA | 19(42%) | 13(295) | 9(20%) | 3(7%) | 1(2%) | 45 |
| | BSc. AnHP | 9(20%) | 13(28%) | 12(26%) | 7(15%) | 5(11%) | 46 |
| | BIRM | 12(26%) | 11(24%) | 12(26%) | 5(11%) | 1(2%) | 41 |
| | BRD | 3(7%) | 20(45%) | 17(39%) | 4(9%) | 0(0%) | 44 |
| | BSc FORESTRY | 10(21%) | 12(25%) | 13(27%) | 6(13%) | 7(15%) | 48 |
| | BSc. HN | 11(22%) | 16(33%) | 19(40%) | 2(4%) | 0(0%) | 48 |
| | BSc. ED | 9(20%) | 12(26%) | 10(22%) | 11(24%) | 4(9%) | 46 |
| Total | | 75(23%) | 98(31%) | 94(29%) | 36(11%) | 18(6%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Mastery | Intermediate level | Novice | Basic level | Total |
| Programm | BA. DS | 15(47%) | 11(34%) | 4(13%) | 2(6%) | 0(0%) | 32 |
| | BA. ED | 3(10%) | 5(16%) | 9(29%) | 13(42%) | 1(3%) | 31 |
| | Mass Com | 8(26%) | 9(29%) | 7(23%) | 4(13%) | 3(10%) | 31 |
| | BCA | 7(23%) | 12(38%) | 7(22%) | 6(19%) | 0(0%) | 32 |
| | BALIS | 6(19%) | 7(23%) | 10(32%) | 6(19%) | 2(6%) | 31 |
| | BSc. ANREB | 7(22%) | 12(38%) | 6(19%) | 6(19%) | 1(3%) | 32 |
| | BSc. Civ. Eng | 7(19%) | 14(38%) | 12(32%) | 4(11%) | 0(0%) | 37 |
| | BSc. Geology | 11(39%) | 10(36%) | 3(11%) | 3(11%) | 1(4%) | 28 |
| | LLB | 8(20%) | 15(37%) | 17(41%) | 0(0%) | 1(2%) | 41 |
| | PESS | 2(7%) | 11(38%) | 11(38%) | 3(10%) | 2(7%) | 29 |
| Total | | 74(23%) | 106(33%) | 86(27%) | 47(15%) | 11(3%) | 324 |

Source: Field data (2021)

Table 4.19 shows that, certain programmes at SUA, especially BSc. AEA (71%), BIRM (56%), BRD (52%) and HN (56%) seem to have larger number of students with skills above average compared to others. BSc. AnHP (52%), Forestry (56%) and BSc. Ed (53%) have relatively larger number of students with skills below mastery. At UDSM, the data pattern shows that, more than 50% of students in 70% of programmes have above average skills to communicate and collaborate online. These include BA-DS (81%), BSc. Geology (75%), BCA (59%), and BSc. ANREB (59%), BSc. Civ. Eng (57%), LLB (56%), Mass Com (55%). However, 30% of programmes have majority of students with limited skills to communicate and collaborate online, namely BA-ED (74%), BA LIS (42%) and PESS (55%). The findings suggest that, some learning experiences may be supporting students' engagements in activities which train skills to communicate and collaborate online in many of the programmes. As such, the mastery of the communication and collaboration online is not determined by nature of programme.

#### 4.2.1.1.4.2 Gender versus skills for communication and collaboration

The study carried out a cross-tabulation to establish the pattern of skills to communicate and collaborate online in relation with gender. The summary is presented in Table 4.20.

**Table 4.20: Gender versus Skills level to communicate and collaborate online**

| | | ***Levels of the skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced | Intermediate level | Novice | Basic level | Total |
| Gender | Female | 41(25%) | 60(37%) | 36(22%) | 19(12%) | 8(5%) | 164 |
| | Male | 32(21%) | 38(25%) | 56(37%) | 17(11%) | 10(7%) | 153 |
| Total | | 75(23%) | 98(31%) | 94(29%) | 36(11%) | 18(6%) | 317 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate | Novice | Basic level | Total |
| Gender | Female | 43(32%) | 44(33%) | 19(14%) | 21(16%) | 8(6%) | 135 |
| | Male | 41(24%) | 58(34%) | 46(27%) | 23(14%) | 1(1%) | 169 |
| Total | | 84(28%) | 102(33%) | 65(20%) | 44(28%) | 9(3%) | 304 |

Source: Field data (2021)

The data from SUA (Table 4.20) show that, 62% of female students rated their skills above average compared to 46% for males. In other words, smaller (38%) portion of female population has skills below mastery compared to males (54%). The data show that, more female students rated higher skills level to communicate and collaborate online over male student counterparts. This implies that, more female students are likely to be better in online communication and collaboration than majority of males. Similarly at UDSM, larger segment of female respondents (64%) rated their skills to communicate and collaborate online above average compared to that of males (59%). The findings add on more evidence that, the participation of females has grown substantially. This suggests undisputable evidence for achievements in terms of gender equality in seizing learning opportunities brought by ICTs (Borokhovski et al., 2018).

#### 4.2.1.1.4.3 Year of study versus skills for communication and collaboration

The data on the cross-tabulation of skills to communicate and collaborate online in relation with year of study is presented in Table 4.22.

**Table 4.21: Year of study versus Skills to communicate and collaborate online**

| | | ***Levels of the Skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Year of Study | First Year | 30(27%) | 32(29%) | 32(29%) | 17(15%) | 6(5%) | 110 |
| | Second Year | 31(28%) | 31(28%) | 31(28%) | 9(8%) | 7(6%) | 109 |
| | Third Year | 9(8%) | 35(34%) | 31(30%) | 10(10%) | 5(5%) | 102 |
| Total | | 70(22%) | 98(31%) | 94(29%) | 36(11%) | 18(6%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | |
| Year of Study | First Year | 33(33%) | 23(23%) | 22(22%) | 19(19%) | 2(2%) | 99 |
| | Fourth Year | 2(8%) | 10(42%) | 6(25%) | 5(21%) | 1(4%) | 24 |
| | Second Year | 30(31%) | 36(37%) | 18(19%) | 12(12%) | 1(1%) | 97 |
| | Third Year | 27(26%) | 37(36%) | 22(21%) | 11(11%) | 7(7%) | 104 |
| Total | | 92(28) | 106(33%) | 68(21%) | 47(15%) | 11(3%) | 324 |

Source: Field data (2021)

SUA based findings as indicated in Table 4.22 present the level of skills to communicate online for 50%, 43% and 45% of students from 1st, 2nd and 3rd years as below mastery. Otherwise, students whose level of skills to communicate online is above average for 1st, 2nd and 3rd years account for 50%, 57% and 55% respectively. This pattern indicates a superficial difference between the years of study, which suggests that, students across years of study exhibit similar attributes in a course of communicating and collaborating online. This also applies for UDSM, whose data demonstrates a closely matching pattern for 1st year (57%) 2nd year (68%), 3rd year (62%) and 4th year (50%). The impression for the two universities indicates that, students have similar tendency of communicating and collaborating online irrespective of the years of study.

#### 4.2.1.1.5 Skills to create and use digital contents ethically

The UNESCO's Digital Literacy Framework recommends the need to equip learners with skills to create and use digital contents and information ethically (UNESCO-IS, 2018). Students with skills in this area are able to organise the information, improve and integrate it into the existing body of knowledge while understanding the ethical implications of practices like plagiarism. Scholars like Shopova (2014) and Jefferies et al. (2016) caution that, students' inability to create and use contents ethically compromise transfer of learning and originality of created contents. Lack of such skills make students to submit assignments and research works that are not properly referenced and cited or; worse still, may submit works that are partly or completely written by someone else (Sharma, 2007).

Qualitative data based on the review of students' assignments across academic years and programmes selected from the studied universities revealed serious features to suggest students' inability to edit, format and integrate contents. Instructors who agreed to provide the submitted assignments for a review highlighted some persistent flaws including poor formatting, copy-paste of information, inappropriate references and citations and typographical mistakes. Like many other instructors, some quotes highlight a state of frustration caused by students' nature of works:

> *It's only that we cannot focus much on their works format and aspects like citations and references because we have large number of student works to look at; the way many of our students write their papers is terrible. Of course we penalize the extremes of copy-and-paste!* (Male instructor, Department of Forestry-SUA. Feb, 2021).

> *I nowadays test students' papers for similarity index after noting from majority of them issues of originality. Many students can't convert what they read from the diverse materials, especially the digital materials, into a context bound papers. They are missing the typical study skills in this regard* (Male instructor, Civil Engineering-UDSM: March, 2021)

Students on the other hand expressed desire to use the accessible electronic reading materials to write good papers/assignments for high grades and to please their instructors. However, some factors inhibit their targets; such as limited support from instructors, nature of contents which do not directly connect to context and questions at hand, language issues and technical strategies to integrate the materials. For example, one student (like many others) stated that: "*Sometimes I want to put my own explanation over the concept but I feel that would compromise the meaning associated with the concept"* (Female 3r Year student, BSc. Forestry-SUA. February, 2021). Another student lamented that: "*Some readings recommended by our instructors have complicated language. It is*

*tricky to comprehend and write something that makes sense out of it"* (Female 1st Year student, BSc. Forestry-SUA. February, 2021).

> *The challenge starts from where you must read many sources to write a paper. After you have all the information needed for the question, sometimes you have forgotten all the details about the sources of information. You just find you have to write a paper with fewer references that the actually cited ones* (Female 3rd Year student, BA. Development Studies-UDSM: March, 2021).

The descriptive data for SUA (Table 4.22) shows that, 24(7.5%) student respondents rated their skills' level as learners; 37(11.5%) are novice and 101(31.5%) have intermediate level of the skills. Other 96(29.9%) and 63(19.6%) claimed to have advanced and professional skills' level respectively. Otherwise at UDSM (Table 4.12b), 16(4.9%), 70(21.6%) and 94(29%) respondents consider their skills as learners, novice and intermediate respectively. Other 81(25%) and 63(19.4%) rate their skills advanced and experts. The general impression based on university data shows that, 50.5% and 54% of students at SUA and UDSM have skills levels which inhibit their confidence to organise information, improve and integrate it the learning tasks in the lines of ethical principles. This is comparatively large number over the 49.5% and 46% of student respondents at SUA and UDSM, who can create and use contents and have some knowledge about ethics in academic writing.

Both descriptive and qualitative evidence indicates that, although some students can write good papers, majority of them are still struggling to create contents with acceptable originality similar to experiences by Shopova (2014) and Jefferies et al. (2016). One of the emerging reasons for this is that, instructors' heavy workload makes them unable to reinforce the desired study skills. The current findings extend Maboe (2016) in Rahayu and Sapriati (2018) which emphasize instructors' responsibility to help students define

the motivation to write papers with acceptable originality. Similarly, Bhatt and MacKenzie (2018) confirmed that, universities can ritualize and sustain the appropriate practices and skills by supporting instructors to design appropriate instructions which habituate the desired skills on students.

The descriptive data to account for patterns of the skills to create and use digital contents ethically is based on the cross tabulation, whose findings are presented in Table 4.23, 4.24 and 4.25.

#### 4.2.1.1.5.1 Study Programme versus ethical creation and use of digital contents

The study carried out a cross tabulation to establish the variations of students' skills for ethical creation and use of digital contents with programme of study. The summary of findings is presented in Table 4.23.

**Table 4.23: Programme versus skills for ethical creation and use of digital contents**

| | | *Level of the skills* | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | |
| Programme | BSc. AEA | 5(11%) | 11(24%) | 14(31%) | 11(24%) | 2(4%) | 45 |
| | BSc. AnHP | 1(2%) | 10(22%) | 12(26%) | 10(22%) | 9(20%) | 46 |
| | BIRM | 4(10%) | 8(20%) | 18(44%) | 8(20%) | 4(10%) | 41 |
| | BRD | 4(9%) | 14(32%) | 20(45%) | 4(9%) | 1(2%) | 44 |
| | BSc. Forestry | 7(15%) | 9(19%) | 14(29%) | 9(19%) | 9(19%) | 48 |
| | BSc. HN | 5(10%) | 8(17%) | 18(36%) | 8(17%) | 5(10%) | 48 |
| | BSc. ED | 7(15%) | 7(15%) | 20(43%) | 7(15%) | 6(13%) | 46 |
| Total | | 33(10%) | 60(19%) | 116(36%) | 60(19%) | 36(11%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Programme | BA. DS | 11(34%) | 10(31%) | 8(25%) | 3(9%) | 0(0%) | 32 |
| | BA. ED | 3(10%) | 1(3%) | 10(32%) | 15(48%) | 2(6%) | 31 |
| | BA. MC | 6(20%) | 9(29%) | 7(22%) | 9(29%) | 0(0%) | 31 |
| | BCA | 1(3%) | 7(21%) | 15(46%) | 4(13%) | 5(16%) | 32 |
| | BA. LIS | 3(10%) | 9(29%) | 12(39%) | 5(16%) | 2(6%) | 31 |
| | BSc. ANREB | 4(13%) | 3(9%) | 9(28%) | 15(47%) | 1(3%) | 32 |
| | BSc. Civ. Eng | 4(11%) | 6(16) | 19(51%) | 7(19%) | 1(3%) | 37 |
| | BSc. Geology | 11(39%) | 9(32%) | 3(11%) | 4(14%) | 1(4%) | 28 |
| | LLB | 8(20%) | 15(37%) | 15(37%) | 3(7%) | 0(0%) | 41 |
| | PESS | 3(13%) | 10(43%) | 7(30%) | 5(22%) | 4(17%) | 29 |
| Total | | 54(17%) | 79(24%) | 105(32%) | 70(22%) | 16(5%) | 324 |

Source: Field data (2021)

The data based on Table 4.23 show that, up to 60%, 67% and 73% of students for BSc. AEA, AnHP and BIRM have skills below mastery. Similarly, students for BRD (61%), BSc Forestry (54%), BSc. HN (65%) and Education (72%) rated their skills below mastery respectively. At UDSM, majority of students in 70% of the programmes rated their skills to create and use digital contents below mastery level. The least, BSc. Geology (71%), BA DS (66%) and LLB (56%) rated themselves skilled above average. The findings in both Universities suggest, irrespective of the nature of the programme that, majority of students have a relatively weaker orientation and therefore encounter some limitations to creating and using digital information and contents. Based on Bhatt & MacKenzie (2018), the appropriate practices and skills can be ritualised and sustained via the institutional instructional practices of schooling throughout university experiences.

#### 4.2.1.1.5.2 Gender versus Skills for Ethical Creation and use of Digital Contents

The study further carried out a cross tabulation to establish the variations of students' skills for ethical creation and use of digital contents with programme of study. The summary of findings is presented in Table 4.24.

**Table 4.24: Gender versus Skills for Ethical Creation & use of Digital Contents**

| | | *Levels of the skills* | | | | | |
|---|---|---|---|---|---|---|---|
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate | Novice | Basic level | Total |
| Gender | Female | 31(23%) | 35(26%) | 31(23%) | 31(23%) | 7(5%) | 135 |
| | Male | 27(16%) | 38(22%) | 60(36%) | 36(21%) | 8(5%) | 169 |
| Total | | 58(20%) | 73(24%) | 91(29%) | 67(22%) | 15(5%) | 304 |
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Gender | Female | 17(10%) | 46(28%) | 59(36%) | 30(18%) | 17(10%) | 164 |
| | Male | 16(10%) | 35(23%) | 55(36%) | 30(20%) | 16(10%) | 153 |
| Total | | 33(10%) | 81(26%) | 114(36%) | 60(19%) | 33(11%) | 317 |

Source: Field data (2021)

The data for SUA in Table 4.24 show that, up to 38% and 33% of female and male students rated their skills on ethical creation and use of digital contents above average respectively. As such, 62% and 67% of males and females students rated their skills below mastery. Although majorities of both males and females rated their skills below mastery, more female students are fluent in ethical creation and use of digital contents compared to males. At UDSM, majority of both female (51%) and male (62%) respondents rated their skills below mastery: However, a marginal variation may not suffice to suggest that females are predisposed to better skills' support over males.

#### 4.2.1.1.5.3 Year of Study versus Skills for Ethical Creation and use of Digital Contents

The study further carried out a cross tabulation to establish the variations of students' skills for ethical creation and use of digital contents with year of study. The summary of findings is presented in Table 4.25.

**Table 4.25: Year of Study versus Ethical Creation and use of Digital Contents**

| | | *Level of the Skills* | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Learner | Novice | Intermediate level | Mastery | Expert | Total |
| Year of Study | First Year | 10(9%) | 19(17%) | 42(38%) | 32(29%) | 7(6%) | 110 |
| | Second Year | 14(13%) | 16(15%) | 42(39%) | 22(20%) | 15(17%) | 109 |
| | Third Year | 6(6%) | 25(25%) | 32(31%) | 28(27%) | 11(11%) | 102 |
| Total | | 30(9%) | 60(19%) | 116(36%) | 82(26%) | 33(10%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Mastery | Intermediate level | Novice | Basic level | Total |
| Year of Study | First Year | 25(25%) | 21(21%) | 25(25%) | 21(21%) | 7(7%) | 99 |
| | Fourth Year | 1(4%) | 4(17%) | 9(36%) | 10(42%) | 0(0%) | 24 |
| | Second Year | 20(21%) | 27(28%) | 28(29%) | 19(20%) | 3(3%) | 97 |
| | Third Year | 19(18%) | 27(26%) | 32(31%) | 20(19%) | 6(6%) | 104 |
| Total | | 65(20%) | 79(24%) | 94(29%) | 70(22%) | 16(5%) | 324 |

Source: Field data (2021)

The data in Table 4.25 show that, 65%, 67% and 62% of SUA students in 1st, 2nd and 3rd years have skills to create and use digital information below mastery level. Other 35%,

34% and 38% for 1st, 2nd and 3rd years have skills' level above average respectively. The pattern shows that, 3rd years students lead by a margin of majority with skills above average. As such, the level of students' skills to create and use digital information is not determined by year of study. The data for UDSM show that, 46%, 48%, 44% and 21% of students for 1st, 2nd, 3rd and 4th year respectively rated their skills above average. This implies that, over 50% of students for every cohort (in both universities) have limited skills to create and use digital contents such that the development of skills with change of year of study is blurred.

#### 4.2.1.1.6 Protecting Personal Data and Privacy in Digital Environment

Data security is a protective process of securing files, databases and accounts in ICT environment (William, Stahl & Karger, 2016). Students' limited skills to protect personal data and privacy in ICT environment create risks such that their data are prone to adverse nonacademic use should it be accessed by hackers or commercial marketers (Krueger & Moore, 2015a). This study conceives the need for students to be proactive than being reactive with their information such as personal identity, recruitment, medical and financial information. Some consequences on student social and academic developments include exposure to harmful contents, threat of violence and bullying.

At the qualitative level, the FGDs explored students' understanding of the types of personal data and different ways to protect personal data and privacy when using ICTs. The data collected show that, majority of students have some understanding of the personal data/information but are unaware of the risks associated with failure to protect such information. Majority of them have not had any experiences associated with

leakage of such information. The FGD further showed that, they are not confident with the mechanisms they use to ensure security of their data. For example, one stated that; "*I have an email, when I log in, surely, sometimes I do not remember to log out!"* (Male 3rd year student-Bachelor of Rural Development-SUA. February, 2021).

Another student to confirm awareness and types of personal information in the context of university: "*In the internet, some websites have spam; I think this is software used to collect peoples' information. This information is used in their businesses" (*Female 2nd Year student-BSc. Ed (Mathematics and Informatics) - SUA. February, 2021).

> *I keep my registration credentials private; I change my account passwords regularly and only share information which is not personal to ensure security and present any leakage of my identity information* (Female 2nd Year student – BSc. Animal Science- SUA. February, 2021).

Further qualitative evidence shows that, some students are aware of the need to protect privacy and personal data/information. They indeed protect information which are neither academic nor family but are however about their malpractice. Such students would lock files with pornographic or simply unacceptable pictures/photos and videos from leaking to friends, teachers or family members either through the ICT devices or social media:

> *There is some information that I don't want people to see. For example, in Facebook and WhatsApp, I can make some setting to restrict some family members from viewing some of my contact friends, photos or videos which may not be pleasant to them* (Female 3rd Year student: B.Com-UDSM: March, 2021).

> *I ensure that my phone galleries do not keep bad movies, photos or any form information that present my bad side [laughter]. Otherwise, I keep my passwords unknown, even to my girlfriend in order to avoid quarrels* (Female 1st Year student, BA. Education- UDSM: March, 2021)

Besides the qualitative data, the descriptive evidence for SUA (Table 4.12a) shows that, 35 (10.9%) student respondents are learners; 44 (13.7%) are novice and 122 (38%) have intermediate skills level. The rest, 95 (29.6%) and 25 (7.8%) respondents, which cumulatively translate to 37.4% consider themselves relatively skilled enough to ensure safety of data and privacy in ICT environment. At UDSM (Table 4.12b), on one hand, 21(6.5%) student respondents are learners; 45 (13.9%) are novice and 101 (31.3%) have intermediate skills level. On the other hand, 87 (26.9%) and 69 (21.4%) respondents, consider themselves relatively skilled enough to ensure safety of data and privacy in ICT environment. The general impression presents 62.6% and 52 % for SUA and UDSM student respondents respectively, who are not/or less confident on skills level to protect personal data and privacy in the ICT environment. This implies their data are in danger of being inappropriately used (Krueger & Moore, 2015a). Following a cross tabulation, the pattern of skills to protect personal data and privacy with pragramme of study, gender and years of study is presented in Tables 4.26 & 4.27.

#### 4.2.1.1.6.1 Programme of Study versus Skills to Protect Personal Data and Privacy

The study carried out a cross tabulation to establish the variations of students' skills to protect personal data and privacy with year of study. The summary of findings is presented in Table 4.26.

**Table 4.26: Study Programme versus Skills for Protecting Personal Data and Privacy**

| | | *Levels of the skills* | | | | | |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Programme | BSc. AEA | 11(24%) | 12(27%) | 12(27%) | 4(9%) | 6(13%) | 45 |
| | BSc. Animal Health And Production | 6(13%) | 13(28%) | 10(22%) | 10(22%) | 7(15%) | 46 |
| | BIRM | 3(7%) | 14(30%) | 11(24%) | 8(17%) | 5(11%) | 41 |
| | BRD | 4(9%) | 18(41%) | 17(39%) | 4(9%) | 1(2%) | 44 |
| | BSc. Forestry | 9(19%) | 16(33%) | 14(29%) | 4(8%) | 5(10%) | 48 |
| | BSc. Human Nutrition | 7(15%) | 15(31%) | 14(29%) | 6(13%) | 6(13%) | 48 |
| | BSc. Education | 15(33%) | 6(13%) | 14(30%) | 6(13%) | 5(11%) | 46 |
| Total | | 55(17%) | 95(30%) | 92(29%) | 44(14%) | 35(11%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | |
| Programme | BA. DS | 8(25%) | 13(41%) | 8(25%) | 3(9%) | 0(0%) | 32 |
| | BA. ED | 3(10%) | 5(16%) | 11(35%) | 6(19%) | 6(19%) | 31 |
| | BA. Mass Com | 8(26%) | 10(32%) | 7(23%) | 6(19%) | 0(0%) | 31 |
| | BCA | 0(0%) | 10(31%) | 14(44%) | 3(9%) | 5(16%) | 32 |
| | BA. LIS | 5(16%) | 7(23%) | 12(39%) | 5(16%) | 2(6%) | 31 |
| | BSc. ANREB | 2(6%) | 12(36%) | 6(19%) | 9(28%) | 3(9%) | 32 |
| | BSc. Civ Eng. | 6(16%) | 12(32%) | 12(32%) | 7(19%) | 0(0%) | 37 |
| | BSc. Geology | 15(54%) | 5(18%) | 5(18%) | 2(7%) | 1(4%) | 28 |
| | LLB | 5(12%) | 15(37%) | 15(37%) | 5(12%) | 1(2%) | 41 |
| | PESS | 7(24%) | 10(34%) | 7(24%) | 2(7%) | 3(10%) | 29 |
| Total | | 69(21%) | 102(31%) | 87(27%) | 45(14%) | 21(6%) | 324 |

Source: Field data (2021)

The data from SUA (Table 4.26) show that, BIRM (59%), BSc. AnHP (59%) rated their skills to protect personal data and privacy above average, followed by students in BSc. HN (54%), BSc. Education (54%), BRD (50%), BSc. AEA (49%) and BSc. Forestry (48%). The pattern offers a picture that, majority of the programmes seem to reflect a large number of students with skills above average. At UDSM, BSc. Geology (71%), BA. DS (66%), PESS (59%) and BA Mass Com (58%) students rated their skills to protect

privacy and personal data above average. As such, other programmes have majority of its students with skills below mastery and therefore cannot protect their privacy and personal data fully. The programmes-divide observed in the current findings is not unique to current study cases. Zhang, Wang and Liu (2021) and Ay & Ederm (2020) noted that, certain programmes had better orientation to some digital literacy skills over others because certain activities in the programmes led to development of such skills. Generally, the impression for the segment of students with skills below mastery in both cases necessitates some improvement to cut across all programmes.

#### 4.2.1.1.6.2 Gender versus Skills to Protect Personal Data and Privacy

Further cross tabulation was used to establish the variations for students with regard to skills to protect personal data and privacy in digital environment with gender. The summary of findings is presented in Table 4.27.

**Table 4.27: Gender Versus Skills For Protecting Personal Data And Privacy**

| | | ***Level of the skills*** | | | | | |
|---|---|---|---|---|---|---|---|
| *Sokoine University of Agriculture* | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Gender | Female | 31(19%) | 49(30%) | 45(27%) | 22(13%) | 17(10%) | 164 |
| | Male | 24(16%) | 45(29%) | 46(30%) | 21(14%) | 17(11%) | 153 |
| Total | | 55(17%) | 84(26%) | 91(29%) | 43(14%) | 34(11%) | 317 |
| *University of Dar es Salaam* | | Expert | Advanced level | Intermediate | Novice | Basic level | Total |
| Gender | Female | 30(22%) | 51(38%) | 22(16%) | 21(16%) | 11(8%) | 135 |
| | Male | 30(18%) | 48(28%) | 60(36%) | 22(13%) | 9(5%) | 169 |
| Total | | 60(21%) | 99(32%) | 82(27%) | 43(14%) | 20(6%) | 304 |

Source: Field data (2021)

Based on details in Table 4.27, majority (49%) of female students have above average level of skills to protect personal data and privacy. This means, 51% of female respondents have the skills below mastery. Up to 45% of males rated their skills'

category above average and therefore 55% of the total rated their skills below mastery. Comparatively, more females have higher level of skills in the area than males, which in other words, more male students have low level of skills in the area. Despite the difference between the two groups, the researcher perceives that, the variation does not suffice to suggest gender as decisive for the difference. At UDSM, the findings are consistent with SUA, as larger segment of female students rated their skills to protect privacy and personal data above average, compared to the male counterparts (46%). The current findings therefore indicate that, female students are likely to operate more successfully in the ICT environment which seems not supportive enough. This perspective is congruent to Cinque & Bortoluzzi (2013), whose observation favors female students with regards to skills to protect personal data and privacy in digital environment.

#### 4.2.1.1.6.3 Year of Study versus Skills to Protect Personal Data and Privacy

The study also carried out a cross tabulation to ascertain a pattern of students' skills to protect personal data and privacy in digital environment on the basis of years of study. The summary of findings is presented in Table 4.28.

**Table 4.28: Year of Study versus Skills for Protecting Personal Data and Privacy**

| | | *Level of the skills* | | | | | Total |
|---|---|---|---|---|---|---|---|
| ***Sokoine University of Agriculture*** | | Expert | Advanced level | Intermediate level | Novice | Basic Level | |
| Year of Study | First Year | 23(21%) | 34(31%) | 26(24%) | 16(15%) | 11(10%) | 110 |
| | Second Year | 18(17%) | 28(26%) | 37(34%) | 15(14%) | 11(10%) | 109 |
| | Third Year | 14(14%) | 33(32%) | 29(28%) | 13(13%) | 13(13%) | 102 |
| Total | | 55(17%) | 95(30%) | 92(29%) | 44(14%) | 35(11%) | 321 |
| ***University of Dar es Salaam*** | | Expert | Advanced level | Intermediate level | Novice | Basic level | Total |
| Year of Study | First Year | 23(23%) | 33(33%) | 24(24%) | 13(13%) | 6(6%) | 99 |
| | Fourth Year | 1(4%) | 10(42%) | 5(21%) | 7(29%) | 1(4%) | 24 |
| | Second Year | 22(23%) | 33(34%) | 26(27%) | 10(10%) | 6(6%) | 97 |
| | Third Year | 23(22%) | 26(25%) | 32(31%) | 15(14%) | 8(8%) | 104 |
| Total | | 69(21%) | 102(31%) | 87(27%) | 45(14%) | 21(6%) | 324 |

Source: Field data (2021)

Responses on the level of skills to protect privacy and personal data with students' year of study (Table 4.28) present categorically that, 52%, 42% and 46% of 1st, 2nd and 3rd year students rated their skills above average. This means, 2nd year class has a largest number of students (58%) who rated their skills below mastery, followed by 3rd year (54%) and 1st year (48%). At UDSM, 57% of 1st and 2nd year students rated their skills above average, followed by 3rd and 4th years students (47% and 46%) respectively. The expected development in the competency area with progression in year of study seems not to be the case in this study. Unexpectedly, more 1st year students gauged their skills higher compared to the number of 2nd, 3rd and 4th years respectively. This view represents a different angle from Cinque & Bortoluzzi (2013) observation that, the skills to utilize ICTs to manage personal data increased with class change. This further suggests that, newer cohorts of students may be more technologically proactive.

#### 4.2.1.2 Patterns of ICT use among students at SUA and UDSM

The study aimed at examining the pattern of ICT use as another way to justify students' own perceived level of digital literacy skills. This was considered on the basis of conceptual framework which regards knowledge (skills) as a result of a combination of abstract and concrete instructions (Lave and Wenger, 1991; Anderson et al., 1995). The study explores the likelihood that students' own-perception of digital literacy skills (in theory) is reflected in the concrete ICT mediated learning activities in line with Learning by doing principle (Dewey, 1938; Kolb, 1984). The type of activities the study sought to confirm (Figure 4.3a &4.4b for SUA and UDSM) is a result of prior review of studies and websites in study universities (eg Mtebe, 2013; Mtebe & Raphael, 2014: 2018; Nalaila, 2015). This part of the objective therefore presents data and findings about the patterns of ICT use among students. This addresses instructors' frequency to use ICTs and engage students in ICT supported learning tasks; students' regularity of participating in ICT supported learning tasks; and instructors' opinions on the quality of students' participation in ICT supported learning.

##### 4.2.1.2.1 Frequency of ICT use among Instructors at SUA and UDSM

The instructors' questionnaire required instructors to state the frequency at which they employ any form of ICT supported teaching with their current students. Out of 62 instructors who completed a questionnaire at SUA, 22 (36%) used ICTs every time; 19 (31.1%) used ICTs almost every time and 19 (31.1%) used ICTs occasionally; the least, 2 (1.2%) respondents almost never used the technologies. At UDSM out of 53 instructors, 1 (2%), 8 (15.7%) and 23 (45.1%) instructors never, almost never and only occasionally used

ICTs for teaching respectively. Other 10 (19.6%) and 9 (17.6%) instructors use the ICTs almost every time and every time respectively.

The data show that, despite a growing pressure for universities to utilise the opportunities of ICTs, its uptake at SUA and UDSM is mixed up, such that, while some instructors use ICTs often, many others use ICTs less. This may not be a surprise because some studies already observed some complexities of mindset among university instructors, which delay the mainstream of ICT use in teaching and learning (Ali, Uppal & Gulliver, 2018; Mtebe, Dachi & Raphael, 2011). However, this provides a picture that the pressure to move some part of teaching and learning activities virtual especially due to Covid 19 and other similar pandemics is likely face serious difficulties at UDSM and SUA. Nevertheless, despite the mixed up frequency of use, the trend indicates that, ICTs have indisputably found a way in the daily teaching and learning. This justifies the validity to investigate the pattern of students' engagement in the ICT mediated learning tasks. It is noted throughout this report that, a higher frequency of a particular ICT mediated activity does not necessarily mean a total replacement of the face-to-face mode of that activity.

#### 4.2.1.2.2 Students' Engagement in ICT Supported Learning Activities

The data to confirm students' engagement in ICT mediated activities was collected through questionnaires (students and instructors), informal discussions (instructors), FGDs (students), and review of students' typed papers/assignments. Students' questionnaire items (based on 5-points Likert scale) required students to state the frequency at which they participated in a given list of ICT mediated learning activities. Thus, 0 represents the status where one never participated in a particular activity (0%); 1 when a person rarely engaged in (up to 20%); 2 for a person who only sometimes engaged in (about 50%); 3 for the one

who often engage in (about 70%) and 4 for those who always performed the ICT mediated task (about 100%). Figure 4.3a (for SUA) and 4.3b (for UDSM) present the summary of descriptive data and its interpretations thereafter.

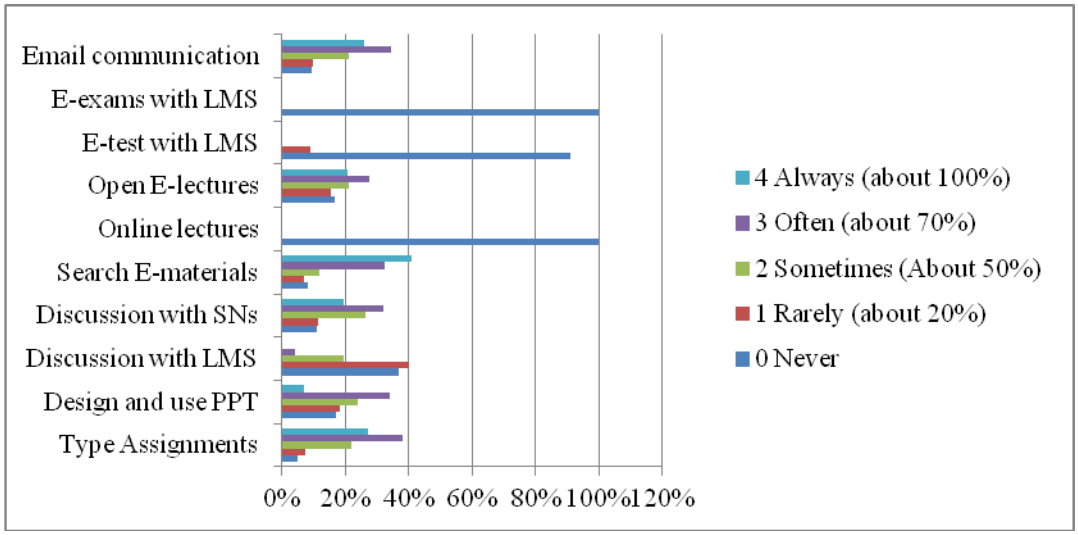



**Figure 4.3a: Pattern of ICT use for learning among Students at SUA**

Source: Field data-SUA (2021)

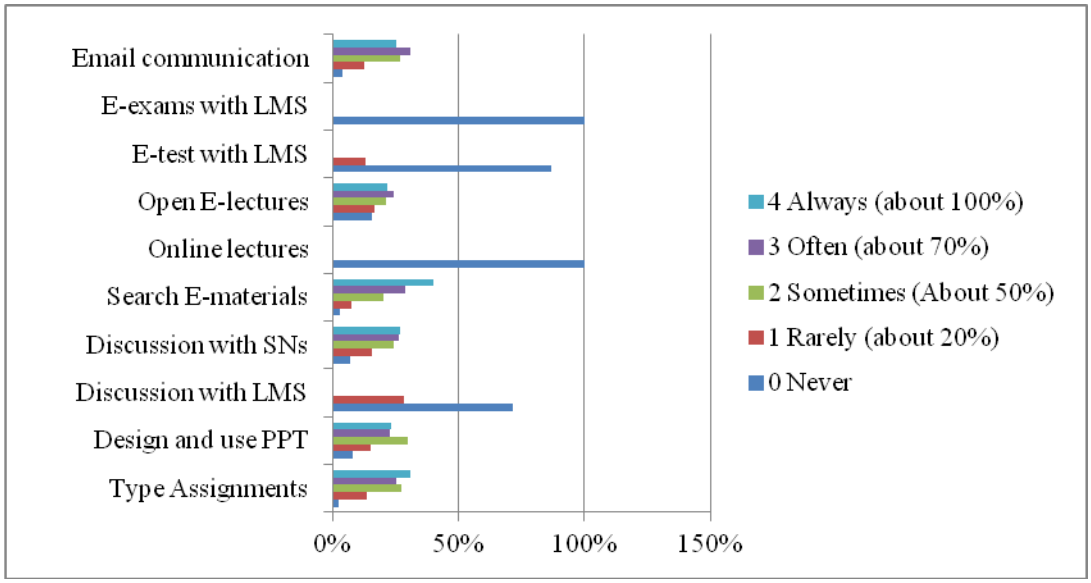



**Figure 4.3b Pattern of ICT use for learning among Students at UDSM (N=325)**

Source: Field data-UDSM (2021)

#### 4.2.1.2.2.1 Typing of Assignments and Papers

Students' assignments in the context of Tanzanian universities take different forms. At both SUA and UDSM, they include individual assignment, where a student is given some project/questions to research on and write a paper as an individual. Assignments are also given in groups, where group of students (as determined by the teacher) is assigned to a question or project to work on and present the report. These are learning tasks for students to work on and the score are normally set to contribute to the final course work grades. While students are expected either to hand-write or computer-type these assignments, the current study noted that, majority of students now use computers to type their assignments. A student can write good paper (assignment) if she/he has adequate skills for computer basic operations and programmes such as word, excel among others. The earlier review by Mungwabi (2017) highlights that, students must also be able to identify material needs, use up-to-date strategies, evaluate, manage and integrate digital information to the available knowledge in order to engage successfully in digital learning.

Informal interviews with instructors to confirm students' tendency to type assignments noted a narrowing room for handwritten assignments in the selected universities with time. Majority of the interviewed instructors emphasize the necessity for students to computer-type the assignments for submission. Instructors believe that neatly typed papers are adaptable, readable, have more accuracy and attract better comprehension of the materials: "*Sometimes I want my students to print their papers so that they (papers) can be easily used by others who may wish to do research on similar topic/question"* (Male instructor, College of Engineering-UDSM: March, 2021). "*I prefer my students to submit typed*

*assignments so that I can read and easily understand" (*Female Instructor, Veterinary Medicines-SUA: Feb, 2021).

> *I can't read students' handwritten submissions! I don't entertain that in my class; In fact I want my students to submit soft copies via email because I may want them to further improve the same* (Male Instructor Forestry-SUA. February, 2021).

The FGD with small groups of 1st year students indicated that, they sometimes tend not to type their assignments; first, because they think it needs much time and a lot of guidelines to type and format the work and; second, because some instructors still accept both printed and handwritten submissions. For example, like several others, one stated that: "*Typing is a new experience that I have not trained adequately. Most of time I feel I better handwrite than typing because I fear making mistakes!"* (Female 1st student-BSc. HN-SUA: February, 2021)

The FGDs with second and third year students indicated that, although they can type, some challenges like inability to type fast and multiplicity and deadlines of works make them either write poorly or seek some help from cyber operators who can type for them: "*Yes, I prefer typing and really wish I can have every assignment typed; but am too slow in typing"* (Female 2nd Year student-BSc. Forestry-SUA. February, 2021)

> *The fear to score low grades due to poor formatting makes us think outside the box [laughter]; when we have drafted the assignment report with the required materials available and everybody in the group is busy, we tend to ask cyber people we trust to type and organise the work. From that, we only need someone to proofread the work ready for printing (*Male 3rd Year Student. BSc. AnHP-SUA. February, 2021).

The qualitative evidence also proved that, instructors do not take some concerns to know the challenges student encounter in relation to the quality of what is typed, which

consequently compromise students' attempts to learn how to type and create better contents:

> *We have instructors who never accept hand-written submissions; they rarely guide students on the better format to write papers because they believe students have taken a computer course. So students who don't have ability to format their papers tend to handwrite and ask the cyber café people for a help* (Male 3rd student LLB-UDSM. March, 2021)

The review of students' typed papers found some common flaws which stem from lack of coherence of ideas, problems with punctuation, inconsistent font case and size, paragraph orientation and typos. The findings suggest that, majority of students' type assignments because of the pressure from instructors, but with little interest. On the other hand, despite the instructors' pressure on students, the attempts to ensure that students write typographical free papers are challenged by the instructors' heavy workloads, as posited by one instructor: "*We try our best, but with the burdensome teaching loads, we can only focus to mark and correct the content part of what students write"* (Male Instructor-Agriculture Economics and Agribusiness-SUA. February, 2021)

With regards to frequency of a particular activity, the descriptive data for SUA (Figure 4.4a) show that, 17(5%) student respondents never typed their works, 24(7.5%) rarely did and 71(22%) did type sometimes. Other 122 (38%) and 87 (27.1%) often and always typed their works respectively. Out of 62 instructors, a total of 38 (62%) engaged students to type assignments between often and always. Otherwise, 1 (2%), 8 (13%) and 14 (22.6%) instructors never, rarely and sometimes engage students in the activity respectively. At UDSM (Figure 4.4b), the data show that, 8 (2.5%) student respondents never typed their works, 44 (13.5%) rarely did and 89 (27.4%) did type sometimes. Other 83 (25.5%) and 101(31.1%) often and always typed their works respectively.

The data pattern shows that, although students are subjected to type assignments and papers, there is still an ease option for students not to type their work as some instructors still accepts handwritten submissions. The findings indicate likelihood that, students' tendency to type assignments/notes is a result of instructors' drive. Despite their force on students to type papers and assignments, majority of instructors do not have time to guide students to improve the associated skills. The review of students' typed papers indicates little improvement made on the ways students type their assignments and papers between academic years. Moreover, the fact that some instructors do not take time to reinforce best practices of typing assignment and papers, students' mastery of the associated skills is likely to take longer.

#### 4.2.1.2.2.2 E-tests and Examinations

The SUA's Examination Regulations and Guidelines (2019/2020) are silent on whether semester examinations or Continuous Assessment activities be carried out on line (SUA, 2019). The current review observed some practices of continuous assessment activities like assignments, tests, quizzes which can be taken via the Moodle LMS. Some activities, however, like examinations are restricted to face-to-face mode based on the standards provided by Tanzania Commission for Universities. In the context where a university has clear policy structures to support these activities on line, students must possess various operational and informational requisites. Primarily, a student has to master computer basic operations and ways to navigate the relevant features of the LMS.

Further qualitative evidence based on interview with ICT technical team (at SUA) and FGD with Moodle coordinators (at UDSM) confirmed less use of LMS for tests,

assignments and quizzes. This implies that, both students and instructors are inconsistent users of the features of the use the technologies, such that, students in particular, are likely to take longer to develop the desired fluency with the features:

> *Of course some instructors administer online tests, especially cumulative test. We normally notice that when students come in numbers to request for passwords of their Moodle accounts! For example, there is one instructor based in the College of Agriculture Sciences and Fisheries Technologies (COAF), who does number of activities online with his students* (KI 1, UDSM. March, 2021).

> *Many instructors still perceive the LMS new and unfamiliar to them. Despite the awareness campaigns in place, only instructors and students for courses related with ICT (particularly those who are taking Informatics and Mathematics) have registered a relatively substantial use* (KI 1-SUA. March, 2021).

The descriptive responses in Figure 4.3a (for SUA) and Figure 4.3b (for UDSM) show that, 100% of student respondents in each university never did any online examination. However, up to 66% percent of the respondents at SUA have not done an online test, except 34% of the total who only did online tests rarely. Similarly, 269(83%) respondents at UDSM have not done an online test, except for 55 (17%) of the total who did online tests rarely. This suggests that, both SUA and UDSM do not have provision/structures for students to conduct online examinations.

The qualitative data based on interview with Support Unit 3 (UDSM) revealed that, any attempts to carry out online university examinations are restricted by standards set by Tanzania Commission for University (TCU). TCU is a body which oversees the conducts and operational standards of Universities: "*There are neither guidelines nor policy which prescribe the type of activities to carry out on line: However, university on-line examinations are restricted by TCU standards"* (Support Unit 3-UDSM-March, 2021).

The study observed that, majority of instructors do not schedule in advance the learning activities to be carried out online and by face-to-face respectively. The tenet in this study highlights that, any shift to uncommon ICT supported modality has to be explicitly communicated to students. That will provide room for the students to make some rehearsals with the technology options in place. In contrast, a technology will likely frustrate the students' focus on contents/subject and consequently demotivate their romance to the technology-and-subject bond. This emerged based on the FGDs with students at both universities: For example a student at UDSM recalled that:

> *In some subjects, a teacher decides on the assignments to be taken on line; you are told when it's just time for it. So, some quizzes are written and submitted off-line but some are carried out via the LMS* (Female 3rd year student-BA. LIS-UDSM: March, 2021).

Portraying a similar state of art at SUA, a student reiterated about one instructor who provided a test online when he was attending a workshop in Dar es Salaam City:

> *It is uncommon practice to do tests online; there has to be some serious reasons. The recent test conducted online was for a course by Dr. X [hidden identity], because we were in pressure to start the final University examinations and the instructor was attending a workshop in Dar es Salaam. The instructor had to arrange with the ICT unit whose staff came to guide us on how to do it* (Female 2nd Year student-BRD-SUA. February, 2021)

Findings from an informal discussion with instructors indicate some challenges to implement and manage online test because of the instructors' fear that students have limited mastery for the use of LMS, large number of students per class, limited support staff and number of connected computers. The following quotes denote some cautions by instructors in both universities about the issues which challenge the attempts to engage students in on-line tests and examination:

> *Of course it is a tricky decision to arrange for a test online; although we hear that students are trained on the use of Moodle, it is unclear if all*

*students have the capacity to make it. It is still unfair to move such activities on line unless one is sure that students can do it* (Male Instructor-Animal Sciences-SUA. February, 2021)

*You really need to be dedicated; the number of students for classes I teach is large to contain in the available computer labs; you need to sufficient computers connected and adequate manpower to manage students distributed to more than one computer labs. Therefore, not everybody can organise that every time!* (Female Instructor, COAF-UDSM: March, 2021).

*We have done some test online; instructors create groups that they could manage in the available computer labs. When others are doing a test in computer lab, others must be locked up somewhere in one of the classes* (Female 3rd Year student: BSc. Ed -SUA: February, 2021).

#### 4.2.1.2.2.3 Open Online Lectures and Tutorials

Open online lecture and tutorial resources in form of a video can be used by students in addition to the basic learning materials prescribed for learning. Such materials may be used to reinforce the taught materials and complete learning tasks provided in class. Students must be able to identify credible sources for the materials and critically analyse the arguments of the resources (Rahayu & Sapriati, 2018). In turn, the use of online lectures and tutorials strengthen students' critical thinking, oral expression and builds positive attitude on independent learning in ICT environment (Mtebe & Raisamo, 2014).

Students were asked to reflect their private learning activities and state the frequency at which they used Open Online lectures and tutorials (eg. from Youtube) to enrich class learning activities and materials. The qualitative data based on FGDs confirm students' use of open lectures and tutorials to enrich classroom learning. They however encounter challenges with the choice of credible and context-relevant materials and difficulties for analysis of contents. Common concerns (across programmes and years of study) include a failure to focus on contents (due to speed of the media); irrelevancy of many media and

difficulty of language. According to Maboe (2016) in Rahayu & Sapriati (2018), such experiences are likely to compromise students' ability to conceive the value of such resources. For example, a relatively common view with first year students highlights familiarity with the technology and access to online lectures and tutorials. The interviewed first year students demonstrated some awareness about the open learning material sources especially from YouTube, and that they opt for such materials when their classroom instructors have not been understandable. However, a majority of them encounter difficulties in searching and selecting the most appropriate media. *"If you subscribe to YouTube, a lot of media pop-up, and sometimes you find it difficult to pick one because you are not sure if that is the relevant one* (Female 1st Year student- BRD-SUA. February, 2021).

A second year student identified a challenge of lack of credibility of the accessed online lectures and tutorials:

> *I am taking science subjects which are difficult; therefore I have to find more possible materials to add on what I did not understand from the classroom sessions; and yet there are media which are not credible. For example some have poor visual and audio quality and some are shallow in coverage* (Male 2nd year- BSc. AnHP-SUA. February, 2021).

Further qualitative data based on third year student respondents identify high cost internet as an inhibitor for the regular use of digital resources. This indicates that, the internet connectivity in campus is inadequate to ensure consistent access to digital resources unless students have alternative:

> *Sometimes you need a lot of time to get a relevant lectures video and you have a lot of works to do! In the end your internet bundle is exhausted and you cannot go on. So you rely on the classroom hand outs and notes* (Male 3rd Year-BSc. HN-SUA. February, 2021)

The descriptive findings based on students' questionnaire at SUA (Figure 4.4a) show that, 55 (17%) respondents never use open online lectures and tutorials; 49 (15.3%) rarely did and 66 (21%) sometimes did. Further in the order, 90 (28%) and 66 (21%) often and always used the online lectures and tutorials respectively. At UDSM Figure 4.4b, 51 (15.7%), 55 (16.9%) and 69 (21.2%) never, rarely and sometimes use open online lectures and tutorials. Other 79 (24.3%) and 71 (21.8%) respondents often and always use the resources besides instructors lecture and tutorial materials. The data for UDSM, just like SUA suggest that, students are adopting the use resources offered by ICTs. However, despite the diversity of open e-resources some students have not taken it as an opportunity to enrich their learning process. Institutional strategies may be needed to fasten the pace of how students embrace the resources.

The responses further show that, majority of students are aware and make attempts to access opportunities associated with open online digital resources. They use such resources to enrich classroom lecture material and for completing assignments and research: "*There are plenty good lectures on line for engineering subjects, especially from India, Japan and America; they are good to build on what our teachers teach us"* (Female student, BSc. Civ. Eng-UDSM. March, 2021).

However, students' use of this type like other on-line resources is challenged by financial inability of students to afford mobile internet bundles. Students claimed about unstable internet offered by university in campus:

> *Yes there is wireless internet at the university; but this is seriously not reliable. You cannot depend on this internet source. The alternative internet source is based on mobile devices; although this is relatively stable, purchasing a reliable weekly internet bundle requires one to have*

*around 5USD; this is too expensive for most of us* (Male Student-BSc. ANREB-UDSM. March, 2021).

The impression about students' use of Open online lectures and tutorials is that, students in the study cases still struggle to search, manage and integrate information to the learning tasks. The factors are seemingly associated with limited support especially in a course of using the resources. This partly seems to emanate from instructors' limited pressure to nature students' culture to critically select and contextualize the e-resources at the students' disposal. Like the observation by Molnar (2017) and Mayer (2014) students going through this experience are likely to lose interest on such resources for learning if unsupported. The current study therefore concurs with Rahayu & Sapriati (2018) view that, universities can enhance the use of these resources by providing mentorship to enable students to utilize the available resources effectively.

#### 4.2.1.2.2.4 The use of e-text materials for Learning

Online resources may be comparable to the information provided by classroom instructors including information from prominent scholars and specialists or experts (Saeed, Ahmed & Ward, 2017). The necessary skills in finding and using e-text resources include searching and evaluating the quality of such resources. Students must be able to determine if a resource is reliable and valid enough to use for the given work. While the frequency of access and use of online text resources/materials is one thing, students' own perception of capability and comfortability to contextualize the materials to learning task are important to justify authentic learning.

The descriptive data for SUA in Figure 4.3a show that, 8% of student respondents never search for the e-text materials; 6.9% of respondents rarely do and 11.8% do it sometimes.

Other 32.4% and 40% of respondents often and always search for e-materials to complement their instructors' notes and for writing assignments/papers. A cumulative majority of 72.4% of students constitutes relatively regular users and the minority of 27.6% of students constitutes irregular users of the e- text resources indicate a growing use of e-resources among students.

At UDSM, (Figure 4.3b), 10(3.1%) of student respondents never search for e-text materials; 24(7.4%) of respondents rarely and 66(20%) do it sometimes. Other 94(28.9%) and 131(40.3%) respondents often and always search for e-materials to complement their instructors' notes and for writing assignments/papers. This makes a cumulative majority (69.2%) of students at UDSM who are relatively regular users while the minority of 27.6% of students is irregular users of the e-text resources, who are likely to be depending on shared or readily print reading materials such as handouts and text books.

Instructors are critical determinant of the pattern in which students use e-resources. Their frequency to provide sequenced learning tasks (individual or group projects) which engage students in the use of e-resources is vital. Data based on questionnaire (at SUA) indicated that, 31(50%) and 14(22.6%) instructors often and always engaged students in activities which required them to search and use e-text materials respectively. Otherwise, 1(1.6%), 2(3.2) and 14(22.6) instructors never, rarely and sometimes engaged students in the said activities respectively. The data at UDSM present 60.4% of instructors who regularly engage students to search and utilize e-text materials along the learning processes. The descriptive data pattern for both students and instructors indicate that instructors' tendency to engage students to use e-materials has corresponding effects on how students use the materials.

The qualitative data based on FGDs show that, students who irregularly use this form of resources are mainly limited by lack of access to computer (or similar devices) to download the materials; they also suffer financial difficulties to afford the devices and confidence to use the accessible university computers: *"I don't have a computer, even a smartphone for downloading the materials and I can't rely on other peoples' computers"* (1st Female student-PESS- UDSM: March, 2021).

> *Yes I did a subject on Basic Computer applications, with some aspects like computer hardware and software, search engines for websites and the use of word processing and spreadsheet software: I should say I have never had enough time to practice to master use of computer* (Male 2nd year student BA. LIS-UDSM: March, 2021).

Further qualitative data based on FGDs with students reveal some challenges in searching and using on-line text material. The emerging findings across programmes and years of study provide an impression that, students are demotivated by large amounts of inaccurate, incomplete, and sometimes distorted information from their searches. For example, a second year student for BSc. Information Technology and Mathematics stated that:

> *Sometimes you spend the whole day and download very many materials such as books, papers and some blog discussions, but later on you realize they do not answer the given question because they all have irrelevant information! (Female 3rd Year-BSc. Forestry-SUA. February, 2021)*

The findings therefore indicate that, besides the high frequency and growing use e-materials for the majority of students at the studied cases, a university has roles to help students understand the basics for searching for specific information known to exist and which is accessible with minimum interference from distracting data.

#### 4.2.1.2.2.5 Discussion via University LMS versus Social Networks

The study sought to confirm the nature of students' use of available technologies for discussion at the university. Students were required to reflect and rate the frequency for their use of University LMS and a WhatsApp mobile platform, a popular social network at the university. Students' responses for SUA (Figure 4.4a) indicate on one hand that, 10.9% of students never used the WhatsApp, 11.5% used it rarely and 26.5% used it sometimes. Furthermore, 31.8% and 19.3% used the platforms often and always. At UDSM (Figure 4.4b), 23(7.1%) students never used the WhatsApp; 51(15.7%) used it rarely and 79 (24.3%) used it sometimes. Furthermore, 85(26.2%) and 87(26.8%) used the platforms often and always. The responses show growing use of social media particularly WhatsApp in the context of teaching of learning. This makes it critical for instruction planners in universities to devise strategies to institutionalize its use for learning.

On the other hand, at SUA, 36.7% and 39.9% of students never and rarely use LMS platform for discussion. Further 19.3% and 4% of students sometimes and often participate in the discussion via LMS platform. At UDSM, 127(20.6%), 114(18.5%) and 84(24.9%) students never, rarely and sometimes participate in the discussion via LMS platform: No students used the Moodle LMS regularly for discussion.

Instructors' responses reflect a relatively similar pattern of the platforms' use, whereas at SUA, 20(32.3%) and 23(37.1%) instructor respondents never and rarely engaged students to use LMS for discussions, 34(54.9%) instructors never engage students in discussions via WhatsApp platform, while 16 (25.8%) rarely and 12 (19%) sometimes do. At UDSM,

26 (49.1%) and 14 (26.4%) instructor respondents never and rarely engaged students to use LMS for discussions. Otherwise, 23(43.4%) instructors never engage students in discussions via WhatsApp platform, while 9(17%) rarely and 15(28.3%) only sometimes do.

The findings show that, while the WhatsApp mobile platform manifests a growing use in the studied universities, much of its academic use among students involves sharing of announcements, reading materials (like lecture handouts), test and examination results. Some of these functions present challenge on the role of LMS in place because it is also used for similar functions. Just like SUA, there is a slight mismatch for the use of WhatsApp social network between students and instructors at UDSM. This suggests that, this platform is mainly used for the interest of students it has a limited academic focus because of the social nature and students' conception of its functions. A comprehension from students' FGDs suggests that; "*WhatsApp platforms are social in nature, such that academic discussions do not last longer because there are a lot of social issues of interest to many students"* (Male 3rd year BSc. Forestry-SUA. February, 2021). "*There is nothing seriously academic that students can discuss in their WhatsApp groups unless there are controls"* (Male instructor, School of Law-UDSM: March, 2021).

Further qualitative data with regard to discussion via Moodle and WhatsApp platforms indicate that, while the irregular usage of Moodle among students is a replica of instructors' pattern, WhatsApp growing use results from the flexibility and social nature of the platform. Students enjoy the use of social networks (WhatsApp in this case) because they can share issues beyond academic topics:

> *Of course WhatsApp is a popular social network among students; students can buy smartphone purposely to subscribe to WhatsApp and to connect*

> *and share with other people news, announcements and other social breaking news!* (2nd Year female BSc. Civ. Eng-UDSM: March, 2021).

The findings confirm the underutilization of Moodle LMS at SUA because it is a recent deployment and that not much has been done to raise awareness for its use. Students' perspective for the low utilisation of LMS is that, instructors have not designed any comprehensive tasks to oblige students' discussion via the LMS. One student reiterated that:

> *Moodle use is uncommon; we visit Moodle in order to see if our lecturers have uploaded some reading materials or any information. In case of some information there, one downloads and easily shares with folks in our WhatsApp groups, such that not everyone has to go there*! (Female 3rd year BIRM-SUA: February, 2021).

The findings based on both qualitative and descriptive data imply that, students make a limited use of the available interactive platforms (namely, Moodle LMS and Social Networks) for collaborative and interactive learning. The findings in this study support Maboe (2016) in Rahayu and Sapriati (2018) in that, university and instructors in particular have a task to help students to define the requirements and benefits of such resources.

#### 4.2.1.2.2.6 Design and use of PowerPoint Presentations

A prior survey at the study case indicated that, PowerPoint presentation (PPT) is a common technology for guiding classroom instructor-students' teaching and learning related interaction. PPT presentations comprise of a number of individual pages or slides. The PPT slides are dynamic and can include text, graphics, sound and other objects which can be arranged by the presenter. Ways in which students design and use of PPT

presentations determine their skills to create and edit digital content in different formats and express themselves through digital means (UNESCO-IS, 2018).

Descriptive data for SUA (Figure 4.3a) based on students questionnaire show that, 23(7.2%) students never used PPT, 26(8.1%) rarely do and 77(24%) only use PPT sometimes. Other 109 (34%) and 86 (26.8%) often and always use PPT technology during presentations. The response pattern indicate that, about 60% of student respondents used PPT presentation often and always, which suggest a significantly frequent use of the technology. At UDSM Figure 4.3b, 27(8.3%) students never used PPT, 50(15.4%) rarely do and 97(29.8%) only use PPT sometimes. Other 75(23.1%) and 76(23.4%) respondents often and always use PPT technology respectively. The responses indicate that, about 53.5% of student respondents use PPT presentation irregularly, which unlike SUA, suggest a relatively low usage of the technology. Comparatively, a larger number of students at SUA use PPT over the respondents at UDSM.

In the same technology use, SUA instructors' perspective based on questionnaire show that, 3(4.8%) instructor respondents never engage students to design and use PPT presentations: About 7(11.3%) instructors rarely engaged students and 21(33.9%) sometimes engage students to design and use PPT for presentations. Otherwise, 17(27.4%) and 14(22.6%) instructors often and always engage students with PPT technology use. At UDSM, 6(11.3%) instructor respondents never engage students to design and use PPT presentations: About 11(20.8%) instructors rarely engaged students and 16(30%) sometimes engage students to design and use PPT for presentations. Otherwise, 11(20.8%) and 9(17%) instructors often and always engage students with PPT technology use. The pattern here shows a slight difference for instructors' pattern to

engage students' between the cases, such that, more instructors at SUA engage students to use PPT over those at UDSM.

Qualitative data based on students' FGDs in both study cases indicate that, instructors use PPT inconsistently and in some schools/colleges. They still make lecture presentations by reading from paper handouts. In turn, students rely on the same lecturer's handout/printouts are unhappy when instructors do not provide access to the handouts because they trust such materials are content rich:

> *In our class, many teachers don't use PowerPoint presentation: They read before us and we take notes. If it pleases a teacher, he/she leaves a lecture handout for us to duplicate and share the print-outs; you can pass exams by just by going through the lecturers handouts* (Male 1st year student, BSc. Ed-UDSM. March, 2021).

The qualitative data based on students' FGDs about the experience for designing PPT reiterated some students' feeling that, it is time consuming because one has to search and organize information from the web or read from text books, integrate the information line with a question in place and then customize the material into the PPT. As such, ones' focus may turn to making a PPT appealing which may consequently compromise the quality of contents or the vice versa: "*The attempts to make the question materials suit the PPT format sometimes end up making us present something different!"* (Female 2ndYear student-BSc. HN-SUA. February, 2021).

The researchers' review of different PowerPoint presentations observed that, despite some good qualities in terms of color, slide design and transition, the PPT pages/slides for many students had overcrowded words, inconsistent font theme and size and lacked citations. This shows that, students are still struggling to use PPT technology and some of

the challenges relate to management of information, editing, formatting, integration and sharing information.

#### 4.2.1.2.2.7 Use of Email Communication

The findings in earlier sections of this chapter revealed that, majority of students perceive their skills to use at least one of the collaborative tools like email, LMS and dropbox between advanced and expert levels. The study sought to confirm the use of email, a popular technology for communication and resource sharing between instructors and among students. Based on the descriptive data at UDSM (Figure 4.3b), 13(4%) student never use email means of communication; 42 (12.9%) and 87 (26.8%) rarely and sometimes do. Other 100 (30.8%) and 83(25.5%) often and always use emails respectively. At SUA Figure 4.3a), 30 (9.3%) students never use emails; 31(9.7%) students rarely communicate via email; 67 (20.9%) respondents sometimes do. Other 110 (34.3%) and 83(25.9%) students often and always communicate via email respectively. Although majority of students often and always use emails, the evidence that some students do not use emails all support the earlier findings that some students have low skills level on the technology.

On the other hand, majority (49.1%) of instructors at UDSM often use emails to communicate with students. This is followed by 22.6% and 21% of instructors who sometimes and always communicate with emails respectively. Further 2% and 6% of instructor respondents never and rarely use email communication with their students. The responses show that, majorities of both students and instructors use email communication over those who never, rarely and sometimes do. At SUA, about 1(1.6%) instructor never

engage students in email communication; 1(1.6%) rarely do and 7(11.3%) sometimes engage students on the technology use. Up to 27 (43.5%) and 26 (41.9%) instructors often and always engage students on email communication.

Apparently, the use of emails among students is growing, partly because of the COVID-19 pandemic, which forced off some modes of interaction which can be easily replaced by technology. Students' FGDs proved that, Covid-19 prevalence has compelled some different forms of interactions which were unpopular before. Findings also suggest that, both instructors and students are rushing to adopt the changes, a rush which is likely to cause inconveniences in ways students' learning take place:

> *There is time during the pandemic when students were required to send some results evidence by email. Instructors' feedback indicated some complaints that the emails by students had serious issues. For example, many students sent different emails for every attachment; email content (text) was written under subject part and many other students used accounts for some other people* (Male 3rd Year student-LLB-UDSM, March, 2021).

The pressing Covid-19 pandemic seems to have exerted more pressure for instructors to cultivate the use emails as an alternative to face to face and hard copy text submissions and resource sharing, which are now associated with risks to transmitting Corona viruses. Despite the growing popularity of this platform of digital communication at both UDSM and SUA, some features denote that, majority of instructors are unhappy with the types of emails students write. This shows that, universities are reactive instead of being proactive. The following quotes justify the weakness of emails students in the study universities write:

> *Pertinent issues with emails majority of my students display include failure to write subject; the whole email body placed as a subject; Lack of continuity, as every reply email is written as a new thread; majority of*

*students, many times don't write salutation* (Male Instructor, School of Law-UDSM. March, 2021)

*Our students can't write good emails: A student can resend the same email, over and over again! Many of them write incomplete email, and many times do not respond on time* (Female Instructor, Veterinary Medicine-SUA. February, 2021)

*Students can't structure good emails and most of them don't have a tendency to read emails regularly. I have even heard many say they have forgotten their email account details. So you can send information via email but you don't receive feedback because this is not something they are punctual with; they prefer and are good with WhatsApp communication* (Female Instructor, College of Agricultural Sciences & Fisheries Technology (COAF)-UDSM. March, 2021).

#### 4.2.1.3 Instructors' view on students' participation in ICT mediated learning tasks

The study further used questionnaires to interrogate instructors' experience and perception of the quality of students' participation on ICT mediated learning tasks. This was an attempt to confirm students' self-report of their digital literacy skills and pattern of ICT use in learning activities. It was, however, taken into account that, instructors' responses presented in Table 4.28 may not be conclusive especially if the digital literacy skills are not part and parcel of pedagogies they emphasize.

**Table 4.28: Instructors' perception of students' participation in ICT mediated tasks**

| | **SUA (N=61)** | | **UDSM (N=53)** | |
|---|---|---|---|---|
| *Perceived Participation Levels* | *Frequency* | *%* | *Frequency* | *%* |
| Very poor | 4 | 7% | 3 | 6% |
| Poor | 13 | 21% | 11 | 21% |
| Average | 30 | 49% | 17 | 32% |
| Good | 14 | 23% | 22 | 41% |
| **Total** | **61** | **100%** | **53** | **100%** |

Source: Field data (2021)

Instructors' descriptive responses in Table 4.28 show that, at SUA, 4(6.6%) and 13(21%) instructors conceive students' participation as very poor and poor respectively. A total of 30 (49.2%) and 14 (23%) perceive the quality of students' participation as average and good respectively. Otherwise at UDSM, 3(5.7%) perceive it very poor; 11(20.8%) see it poor and; 17 (32.1%) respondents conceive students' participation as average. A total of 22 (41.5%) instructors feel students' participation in ICT supported learning tasks as good. The instructors' response patterns suggest a perspective that, students' participation in ICT supported learning needs significant improvement.

Instructors were further asked to explain the consistent learning attributes displayed by learners, which define their level of digital literacy skills and the use ICT for learning. Some attributes that stand out prominently are mainly weaknesses in such aspects like searching, evaluating, integrating and presenting information. The following quotes represent instructors' reflection of ICT use practices for 1st, 2nd and 3rd Year students respectively:

> *Weaknesses in the use of services like track change, spelling check, anti-plagiarism software etc. Majority do not abide by power point presentation good practices; some take too long to check mails-they do well with WhatsApp; when writing assignments/proposals/research results, they face difficulties with layout, numbering, creation of reference list and table of contents* (Female Instructor's reflection of weakness among 3rd Year students: Agriculture Economics & Agribusiness).
>
> *Students do not observe ethics in writing and they do not know how ICT is used for learning at the university. ICT use in learning is NOT valued rather they use ICT as a way of socializing with friends [sic] (*Male Instructor's reflection of weakness among 2nd Year students-Rural Development)
>
> *Most students do not know how to type, format assignments; cannot use presentation technologies, mostly copy and paste internet materials in the assignment: Sokoine University of Agriculture has just developed*

> *ICT policies on the use of ICT for teaching e-learning [sic]. We hope these issues will be taken care-of* (Male instructor's reflection of weakness among Year 1 students: Animal Science).

The quotes above highlight some persistent weaknesses with outputs of students' ICT-supported learning task. This draws some attention as majority of students self-rated their digital literacy skills as intermediate and advanced on many aspects of associate digital literacy skills. The findings based on researcher's observation and instructors' opinions indicate that, students' actual use of ICTs is coupled with several weaknesses. Besides, although students conceive their own digital literacy skills relatively high, instructors still challenge their output. This suggests that, students have misconception of their level of digital literacy skills. Therefore, instructors must help students to re-define their conception of digital literacy skills based on what they (students) should do to improve learning outcomes.

The overall findings show that, although majority of students have the basics to operate computers or similar device, like turn on/off, lock, charge and access basic operations, a significantly large segment still cannot. This means, there are students at the university who are unable to carry out any learning activity by using a computer (or similar device). In addition, majority of students consider their skills to operate basic features Moodle Learning System low as they can hardly navigate user account, log in/off and do privacy setting. Such students are therefore unable to use the features offered by the LMS, such submission of assignments, discussions, tests/quizzes, among others. The findings in this study reflect Byungura et al. (2018) observation at University of Rwanda, where students were digitally illiterate to learn with ICTs. Like the experience in Tanzanian Universities, the difference in levels of digital literacy are likely to be

attributed by the differences exposure to ICTs, frequency of ICT use and training on use of technologies available at the university.

However, the study noted that, both UDSM and SUA offer basic computer application course to fresher students, one of whose learning objective is to train student to learn with ICTs. Despite the subject(s), students still display limited capacity to use computers and the LMS in place. The findings in this study highlight a mismatch between instructors and students on the frequency of using LMS versus social networks as platforms of learning. This is an extension of what Mtebe (2017) observed at UDSM, a "*differentiated coping with changing technology"* because instructors were trained to use Moodle while students self-trained to use social networks.

The current findings indicate that, the subject(s) related to ICT application are theoretically taught for the students to answer examinations. Based on a similar observation, Chan, Churchill and Chiu (2017) opine that, students will develop the required level of digital literacy skills when the ICTs are part and parcel of the learning activities. The emphasis has to be placed on the skills that are part and parcel of everyday learning. This also means that, these skills must be embedded in the available teaching and learning practices.

The findings further highlight that, students at SUA and UDSM have deficiencies in majority of informational literacy aspects interrogated. They encounter difficulties in identifying information/material needs, using up-to-date search strategies for the digital materials and tailoring them rightly to learning tasks. Based on Eisenberg and Berkowitz (1990) observation, students in such learning experience cannot reflect on

the type of information needed and therefore find it difficult to learn efficiently and find right solutions to learning tasks.

Similarly, this study observed majority of students who struggle to make choices of credible materials and contents to use in their learning tasks. Their attempt to evaluate the relevance and credibility of materials are limited to what their search results offer. This is similar to the findings by Bhatt and MacKenzie (2018), observed the same and consequently cautioned that, such reliance does not guarantee veracity and quality of information. According to Bendersky et al. (2012), students must be trained on how to select the learning materials that reflect learning task. Based on this angle of proposal, Breakstone et al. (2019) identified the risks associated with a lack of evaluative skills, including misinformation and misconceptions of what students are expected to learn.

Further findings indicate that, students' low level of digital literacy skills is likely to be caused by limited use of the available ICT supported platforms of communication and collaborative learning like emails and the Learning Management System. Students can use these platforms to interact, collaborate and share data and information with others for construction and co-creation of resources and knowledge. Students are unaware of some other collaborative tools which are popular among instructors like dropbox and Googledrive, which indicates that, universities have a pending business to expose students to more research and learning tools

Although majority of students often use emails to communicate with instructors, they often write emails with serious flaws/weaknesses. Both students and instructors conceive the flexibility and ease of use for the WhatsApp platform: However, it is

mainly used for non-academic activities. The current findings relate to Nzuki's (2014) observation in Kenya, where some ICT tools never realized the appropriate use due to poor perceptive on the pedagogical strategies employed in training the users about its optimal usage. This calls for substantial efforts to make students aware and knowledgeable of the opportunities offered by the available ICTs.

The study confirmed a growing popularity of digital contents to complement the instructional materials available via physical books. However, majority of students consider themselves having limited skills on how to organise, improve and integrate digital information into the learning tasks in line with ethical standards. Both qualitative and descriptive evidence have shown some flaws like poor formatting, copy-paste of information, inappropriate referencing and citations and typographical mistakes. The findings reflect Shopova (2014) and Jefferies et al. (2016) experience that, students' inability to create and use contents ethically compromise transfer of learning and originality of created contents. These are typical characteristics which indicate unauthentic learning resulting from lack of informational literacy among students (UNESCO-IS, 2018).

The findings further highlighted that, majority of students have some understanding of the personal data in the context of schooling, they are proactive to protecting data about their malpractice relating to pornographic or simply unacceptable pictures/photos and videos. They are less knowledgeable of the risks associated with poor protection of useful personal data and privacy about academic details (eg. registration), financial accounts and citizenship details. Based on the observations by Krueger & Moore

(2015a), the behaviors make most of students at risk, and in the long run, may frustrate their academic development.

### 4.2.2 Teaching and Learning Activities and Students' DLSs at SUA & UDSM

The focus of the study in this section is to answer a question *"What influence do the teaching and learning activities have on students' acquisition of digital literacy skills for learning at the selected universities in Tanzania?"* This urge draws from Situated Learning Theory (Lave & Wenger, 1991), which suggests that, digital literacy skills must be part and parcel of both abstract and concrete instructions in school (Dewey, 1938; Kolb, 1984). Similarly, UNESCO-IS (2018) recommends for universities to implement pedagogical practices that promote students' digital literacy skills for learning (Nerland & Prøitz, 2018). Findings under this objective advance the analysis of the nature of teaching and learning activities and its implication on students' digital literacy skills for learning among students in the studied universities. Key aspects include whether or not the subject contents, instructor activities, learners' activities, students and instructors' preparedness and other frameworks are tailored to develop students' digital literacy skills (Wang, 2011). Sources of data to furnish this objective draw from student and instructors' perspectives, Key Informants and researcher's observation of various learning sessions.

#### 4.2.2.1 Optionality of ICT for teaching and learning at SUA and UDSM

Findings about the optionality for the use of ICT in teaching and learning show that, 48 (77%) instructors at SUA perceive the freedom to choose to or not use ICTs for teaching. The least, 14(22.6%) consider that the use of ICTs is mandatory. At UDSM, up to 46

(86.8%) instructors perceive the use of ICTs for teaching and learning as optional and 7(13.2%) take it mandatory. The study finds that, the use of ICTs for teaching and learning at the selected universities remains optional despite the ICT investments made. For both universities, this leniency is connected to lack of institutional strategies to mainstream ICT supported pedagogies. Instructors have choice of the frequency and nature of the ICT mediated teaching and learning the technology should support, which in both the short and long run, is likely to inconvenient students' acquisition of digital literacy skills. This dilemma reflects the ill-preparedness of the selected universities to implement comprehensive ICT supported students' learning in case of emergencies, like the Covid 19 pandemic (Mtebe, Fulgence and Gallagher, 2021). This study further connects to Balas (2015) observation, both of which attribute this level of optionality as a predictor for an inconsistent use of ICT which may cause some systematic variations on how students learn with ICTs. Students who conceive ICT use as optional will consequently fail to acquire the necessary skills to learn with ICTs.

This study noted that, the optionality is partly due to lack of strong policy provision which emphasise for a necessity of instructors to embed ICT in their instructional design and implementation. It is further amplified by instructors' perception about the available infrastructure and value to sustain ICT supported teaching operations. Instructors in both universities are concerned that, universities must address issues such as internet connectivity, large number of students and workload burden and the capacity of instructors to sustain students' use of technology for learning:

> *We must address some issues for a shift to significant ICT supported forms of teaching: As for now, many of the campaigns to use ICTs do not answer the critical questions about infrastructure and relevant skills for both instructors and students (An instructor UDSM: March, 2021).*

> *The university cannot make the use of its platforms mandatory for teaching and learning; that will be impractical given the infrastructure in place, workload, and number of students, connectivity and capacity of instructors to use ICTs. For example, I use my own internet support, computer and buy my own books!* (An instructor, SUA: February, 2021).

Based on the cited quotations, majority of instructors in selected universities are concerned with some issues the universities must address. These include poor internet connectivity, unbearable number of students and workload burden and the skills capacity of instructors to sustain students' use of technology for learning (English, 2016). While such challenges are not unique to the studied universities, some evidence especially in SSA universities suggest that, the challenge of ICT infrastructures is exaggerated. Nzuki (2014) for instance observed that, some ICTs infrastructure and facilities such as Moodle LMS, e-resources databases and Social Networks are underutilized because of ignorance, limited awareness, interest and skills. As such, the use of ICTs in certain universities in both developed and developing countries continue to lag behind not because of inadequate infrastructure but laxity caused by limited administrative interventions (Nerland and Prøitz, 2018; Balas, 2015).

#### 4.2.2.2 Classroom support for Students' digital literacy skills for learning

The study explored some evidence on whether instructors support students' acquisition of digital literacy skills in a course of teaching. The forms of support are a result a benchmark based on UN's Digital Literacy Framework (2018); studies from OECD countries (eg. Nerland & Prøitz, 2018; Handley, 2018): SSA in general (Blum, 2019; Common Wealth of Learning-COL, 2012 and Nzuki, 2014): East Africa and Tanzania in particular (Barakabitze et al., 2019; Mtebe and Raphael, 2018; Nalaila, 2015; Nihuka and Voogt, 2012). The review provides a synthesis of diverse practices to foster students'

acquisition of digital literacy skills in the context of learning. It is noted however that, the ICT use practices vary in terms of contexts, scope, and level of development of a particular country/entity (Internet Society, 2017). The gauged forms of support (Table 4.29a and 4.29b) reflect ICT use practices and experience in studied institutions. Such forms offer useful determinant of students' learning experiences leading to their level of digital literacy skills for learning and later on for career purpose

The review also draws from the UN's Digital Literacy Framework (2018) which highlights among other things the key competence areas and skills necessary for graduates and youths. The proposed list of support forms was also subjected for scrutiny by scholars in areas of Blended learning, curriculum planning and implementation, study skills, Information literacy and Library studies in the context of Tanzania. The aim of this scrutiny was among other things, to ensure that the study is as SMART enough to elicit context-specific data. Various such inputs were used to structure a question which is used to elicit instructors' self-perception of the frequency of providing such support to students. Instructors were required to indicate the frequency at which they offered the support forms using a 5-points likert scale between zero (0) which means the instructor *never* supported students, to 4, that the instructor *always* supported students on a particular form. Table 4.29a presents data from UDSM while Table 4.29b presents data from SUA.

**Table 4.29a: Instructors' classroom support for students' DLs at UDSM (N=53)**

| | | Frequency of classroom support form | | | | |
|---|---|---|---|---|---|---|
| # | **Form of Classroom Support** | *Never* | *Rarely* | *Sometimes* | *Often* | *Always* |
| i | I encourage them to use opportunities brought by ICTs and social networks in learning activities and collaboration | 0 (00%) | 6(11.3%) | 11(20.8%) | 22(41.5%) | 14(26.4%) |
| ii | I identify in advance the type of activities to be done through face-to-face and others through on-line mode | 6(11.3%) | 13(24.5%) | 13(24.5%) | 18(34%) | 3(5.7%) |
| iii | I guide my students on how to avoid plagiarism (eg how to make good notes, use of citation, quotation and proper referencing for e-resources) | 4(7.5%) | 7(13.2%) | 8(15.1%) | 22(41.5%) | 12(22.6%) |
| iv | I guide them to manage digital distraction when using digital tools for learning | 8(15.1%) | 7(13.2%) | 12(22.6%) | 22(41.5%) | 4(7.5%) |
| v | I guide them on how to manage online identity/footprint and being respectful with online interaction and in sharing meaningful information | 10(18.9%) | 14(26.4%) | 11(20.8%) | 15(28.3%) | 3(5.7%) |
| vi | I embed tasks for critical thinking to enhance their use of information from the digital environment | 6(11.3%) | 10(18.9%) | 16(30.2%) | 18(34%) | 3(5.7%) |
| vii | The mastery of digital literacy skills in class are also reflected in the purpose of Tests and Examinations | 12(22.6%) | 10(18.9%) | 22(41.5%) | 6(11.3%) | 3(5.7%) |
| viii | The course syllabus indicates learning activities and outcomes which reflect the mastery of digital literacy skills | 13(24.5%) | 13(24.5%) | 16(30.2%) | 11(20.8%) | 0(00%) |
| ix | I structure the teaching activities to create synergy between the ICTs and subject-based learning activities with the aim of developing both as interdisciplinary set of skills | 6(11.3%) | 9(17%) | 22(41.5%) | 15(28.3%) | 1(1.9%) |
| x | I advise where to seek support in such aspects like installation, maintenance/repairs of their ICTs for learning. | 14(26.4%) | 10(18.9%) | 12(22.6%) | 14(26.4%) | 3(5.7%) |

Source: Field data-UDSM (2021).

The descriptive data summary in Table 4.29a presents two classroom support practices majority of instructors implement to support students' digital literacy skills at UDSM. About 41.5% and 26.4% of instructors often and always encourage students to use opportunities brought by ICTs and social networks in learning activities respectively. Instructors' word of encouragement has positive impact on the frequency and level of technology use among students. For instance, instructor's positive comment on the use a certain technology is likely to promote students' creative use of the technology (Aboelzahab, 2020). This implies that, students who do not find instructors' positive comment about the technology are likely to lose interest on the technology and its use. In addition, a cumulative majority (64.1%) of instructors guide students in classroom on how to avoid plagiarism (eg how to make good notes, use of citation, quotation and proper referencing for e-resources). This implies that, majority of instructors may be having time to discuss with students about ways to integrate the digitally accessed contents into learning tasks. Unfortunately, for some instructors, hints on how students should avoid plagiarism related behaviors seem not to be part and parcel of their teaching. Students who are modeled by such instructors will struggle to develop a consistent capability to learn with the ICTs (Shopova, 2014).

The study found that, most of the classroom practices to support students' acquisition of digital literacy skills at UDSM are limited as majority of instructors implemented them less often. For instance, over 60% of instructors less often identify in advance the type of activities to be done through face-to-face and on-line modes respectively. This is likely to cause some systematic variations on how students conceive the intended practices (Balas, 2015). Up to 70% of instructors design teaching activities which less often reflect a

synergy between ICTs and subject-based learning activities as interdisciplinary set of skills for a student. This implies that, students in many subjects are not informed about the nature of technology use and how it connects to their career. This is likely to compromise their participation, reduce their power to flip learning and struggle to connect technology and subject contents (Jefferies et al., 2016; Rahayu and Sapriati, 2018). Up to 50% of instructors less often guide students to manage digital distraction when using digital tools for learning. This means, a similar segment of instructors do not consider the disruptive nature of technology as a challenge to their students. Similarly, majority (66.1%) less often guide students on ways to manage online footprint. Less than 40% of instructors whose students have some insights about the risks associated with online footprint. This indicates a possibility that majority of students are prone to unsafe online interaction. For over 79% of instructors, less often their course syllabi indicate learning activities and outcomes which reflect the mastery of digital literacy skills. This makes it difficult for the students to anticipate the nature and therefore rehearse the best practices. Besides, for majority of instructors (86%), the mastery of digital literacy skills in class is less often evaluated through tests and examinations. There is no clear evidence that it is regarded as important learning outcomes students should acquire along their learning experiences.

**Table 4.29b: Instructors' classroom support for students' DLSs at SUA (N=62)**

| | | Frequency of classroom support form | | | | |
|---|---|---|---|---|---|---|
| # | **Form of Classroom Support** | *Never* | *Rarely* | *Sometimes* | *Often* | *Always* |
| i | I encourage them to use opportunities brought by ICTs and social networks in learning activities and collaboration | 4(6.5%) | 1(1.6%) | 7(11.3%) | 28(45.2%) | 22(35.5%) |
| ii | I identify in advance the type of activities to be done through face-to-face and others through on-line mode | 0(00%) | 12(19.4%) | 25(40.3%) | 19(30.6%) | 4(9.7%) |
| iii | I guide my students on how to avoid plagiarism (eg how to make good notes, use of citation, quotation and proper referencing for e-resources) | 0(00%) | 5(8.1%) | 10(16.1%) | 19(30.6%) | 28(45.2%) |
| iv | I guide them to manage digital distraction when using digital tools for learning | 7(11.3%) | 10(16.1%) | 20(32.3%) | 14(22.6%) | 11(17.7%) |
| v | I guide them on how to manage online identity/footprint and being respectful with online interaction and in sharing meaningful information | 8(12.9%) | 11(17.7%) | 21(33.9%) | 18(29%) | 4(6.5%) |
| vi | I embed tasks for critical thinking to enhance their use of information from the digital environment | 5(8.1%) | 15(24.2%) | 21(33.9%) | 17(27.4%) | 4(6.5%) |
| vii | The mastery of digital literacy skills in class are also reflected in the purpose of Tests and Examinations | 7(11.3%) | 19(30.6%) | 11(17.7%) | 19(30.6%) | 6(9.6%) |
| viii | The course syllabus indicates learning activities and outcomes which reflect the mastery of digital literacy skills | 6(9.7%) | 13(21%) | 15(24.2%) | 23(37.1%) | 5(8.1%) |
| ix | I structure the teaching activities to create synergy between the ICTs and subject-based learning activities with the aim of developing both as interdisciplinary set of skills | 4(6.5%) | 14(22.6%) | 22(35.5%) | 15(24.2%) | 7(11.3%) |
| x | I advise where to seek support in such aspects like installation, maintenance/repairs of their ICTs for learning. | 9(14.5%) | 13(21%) | 23(37.1%) | 11(17.7%) | 4(9.7%) |

**Source: Field data-SUA (2021)**

The pattern of descriptive data for Sokoine University of Agriculture (Table 4.29b) matches that of University of Dar es Salaam as majority of support practices are limited. Like UDSM, only two forms of skills support practices emerge among majority of instructors at SUA: Over 80% of instructors encourage students to use the opportunities associated with the technology and up to 76% of respondents offer some guidance about ethical ways students should write plagiarism-free learning tasks. Based on the responses in Table 2, data shows that, the mechanisms to foster students' skills to learn with ICT at SUA just like UDSM are inadequate. Majority of instructors neither communicates to students the expected mix of online and face to face learning tasks (60%) nor plan for the learning outcomes which reflects students' mastery of digital literacy skills (65%). Similarly, the course syllabi for 55% and evaluation mechanisms like tests and examination provided by instructors (65%) do not reflect the mastery of digital literacy skills. Other less often provided support forms include ways to manage digital distraction (62%); managing online footprint (64%); and guidance to installation/repair/maintenance services (73%).

Generally, the findings indicate some practices to support students' acquisition of digital literacy skills for learning at UDSM and SUA. However, such practices appear to be disjointed and uncoordinated because they are implemented by individual instructors who seem to have some interest on the technology use. For majority of instructors, many forms of support (based on checklist) are inconsistent and therefore insufficient to develop students' capability to learn the use of ICTs. The critical components digital literacy skills are not adequately treated as part and parcel of the classroom instruction. The findings connect to previous studies like Shopova (2014) and Jefferies et al. (2016) where students were unable to create and use contents ethically, and could not transfer learning as a consequence of limited classroom

support. In line with Speckman and Mandew (2014), students are likely to continue experiencing difficulties to adapt and learn with the ICTs and consequently graduate without the key digital skills for lifelong learning. Logically, instructors have a role to play: Based on Nerland and Prøitz (2018) and Handley (2018) from OECD experience, that depends on their preparedness.

#### 4.2.2.3 Instructors' preparedness to support students' DLs

The study further interrogated the instructors' perception of their own preparedness to support students' digital literacy skills for learning, especially through the teaching and learning activities. Instructors were asked to reflect about their own preparedness to embed the support forms across planning, designing, implementing and assessing teaching and learning activities. The data (in Table 4.31) provides the responses and its interpretation thereafter:

**Table 4.30: Instructors' preparedness to support students' DLSs at SUA & UDSM**

| | | **SUA (N=62)** | | **UDSM (N=53)** | |
|---|---|---|---|---|---|
| | ***Level of preparedness*** | ***Freq.*** | ***(%)*** | ***Freq.*** | ***(%)*** |
| 0 | Not prepared at all | 14 | 23% | 2 | (4.5%) |
| 1 | Not much prepared | 7 | 11% | 11 | (21%) |
| 2 | Somewhat prepared | 26 | 42% | 36 | (68%) |
| 3 | Moderately prepared | 12 | 19% | 4 | (8%) |
| 4 | Well prepared | 3 | 5% | 0 | (0%) |

Source: Field data (2021)

The responses based on Table 4.31 show that, 14 (22.6%) instructors at SUA are not prepared at all; 7 (11.3%) are not much prepared and; 26 (41.9%) are somewhat prepared. Other 12 (19.4%) and 3 (4.8%) claimed to be moderately and well prepared respectively. At UDSM, the descriptive based on Table 15 show that, 2(3.8%) instructors are not prepared at all; 11 (20.8%) are not much prepared, 36(67.9%) are

somewhat prepared and; 4(7.5%) are moderately prepared. Comparatively, 74 % and 92% instructors at SUA and UDSM respectively are not confident of their preparedness to support students' digital literacy skills.

Qualitative data from both universities show that, some training are organized to support instructors' mastery of ICT supported pedagogies. For example, at UDSM, the Center for Virtual Learning (CVL) trains instructors in groups as well as on individuals' basis to ensure instructors' use of the LMS to interact with students. This also applies to SUA, where the Center for ICT (CICT) arranges trainings to support instructors' use of Moodle for teaching. At UDSM, Support Unit 3, for instance, stated that: *"The university guarantees training on ways instructors should use the ICT infrastructure in place; I admit such trainings are not extended to students"* (Support Unit 3 UDSM. March, 2021). The Moodle Coordinator further stated that:

> *We call for instructors' training at least at each semester start: We also have a tendency of advertising through the University platforms about the trainings we offer so that any teacher with an issue can just call us at his/her convenience. The trainings focus on the basics of features of Moodle, for example how to upload contents, how to set assignments, how to interact with students and administer quizzes and conduct discussions (KI 1 UDSM. March, 2021).*

The KI 1 at SUA similarly acknowledged that, training of instructors mostly focuses on LMS (Moodle) use and that, the roles to support students' use of ICT is left to Moodle coordinators and teachers for a subject on *Basic Computer Application*, a general Computer related course/unit which is taught to fresher students across university:

> *Apart from training instructors on how to navigate Moodle and telling students on how to access learning tasks in the Moodle, nothing much about students' acquisition of DLSs discussed in the training* (KI 1-SUA: February, 2021).

Some informal discussions with instructors in the two universities indicate that, while they acknowledge some trainings and workshops to spearhead the use of ICTs, they still vary on the level of implementing the ICT use, especially on various features of LMS. Some instructors are skeptic that the current capacity building initiatives do not suffice to make them users of the advocated ICT use practices because some challenges like poor connectivity, heavy workloads are unattended.

> *How can I provide online test? Who knows whether students have a computer? How do I manage such big classes? And under which source of internet? Some of these things will remain theoretical and unrealistic!* (Male Instructor, College of Agricultural Sciences and Fisheries Technology (COAF) UDSM. March, 2021).

Based in the descriptive and qualitative data in this section, the study arrives at the following observations: Firstly, "*digital literacy skills"* in the context of supporting students' learning with ICT is a relatively new concept, at least with instructors and ICT personnel's in the studied universities. Instructors conceive digital literacy skills for students as crucial but something which has not been part and parcel of what transpires in the design and implementation of teaching and learning. The support provided to students for some of the digital literacy skills seems to be a "by-the way" because they are neither planned in advance nor considered in evaluation of learning outcomes.

Secondly, there is an assumption that, teaching students to operate computer or a similar device suffices to guarantee students' ability to learn with ICT. As such, instructors and Moodle coordinators expect that, students are automatically able to learn with ICTs. As such, this suggests a long way to go for the authentic integration of technology into the day-to-day teaching and learning activities in universities unless students are made part of the targets of technology use. In the first place,

universities and policy makers will have to abstain from looking at ICT use as a mere use of computers to upload and download materials through the university installed LMSs/Moodle platforms. Instructors have to be supported to help students to learn how to learn with ICTs. As such, adequate trainings will have to cover a range of both operational and informational aspects of ICTs to sustain the mainstream.

Scholars have conceived with seriousness the UNESCO's requirement to promote digital literacy skills for students as a tool for authentic learning. Critical to this study, other studies also highlight the role of instructors who teach students in universities with some ICT supported instructions. For instance, Monteiro & Leite (2021) study in in public Portuguese HEIs found that, students had developed some literacy skills based on peer interaction, but lacked confidence because their teachers were not involved in their skills development. At some other stages, students at the Georgia State University Honors College (US) had negative comments about one of their instructors who did not seem to have much digital literacy himself; so students expressed some disappointment that "*it was hard learning from someone who was learning at the same time*" (English, 2016).

Instructors' ill-preparedness to support students' digital literacy skills suggests a long way to mainstream authentic integration of technology into the day-to-day teaching and learning activities. The better way forward, universities and policy makers will have to abstain from looking at ICT use as a mere use of computers to upload and download materials through the Learning Management Systems in place (Nerland and Prøitz, 2018). Instructors have to be supported to help students to learn how to learn with ICTs (Wiegel, 2020). This necessitates adequate trainings to cover a range of both operational and informational aspects of ICTs to sustain the mainstream.

University educators who are ill-prepared to support students' use of technology in universities are likely to be despised by what Schmidt (2012) call "*Net Generation*" for lagging behind in terms of knowing the most current technology for learning. Schmidt's (2012) described the misperception of the net generation students as quite digital literate rather actually less comfortable with diverse uses of technological media and digital applications. This cautions institutions and governments to focus on instructors' professional development and ensure that they are informed of the current and relevant digital platforms and what students need to learn best (Handley, 2018; Wiegel, 2020).

The data, findings and discussion under this section provide a comparatively same picture that students in the selected universities perceive similar deficiencies related to their operational and informational literacy skills. Such deficiencies are also reflected in students' actual ICT use for learning and based on instructors' opinions. The deficiencies present room for students' unauthentic learning with the ICTs. In addition, the use of the ICTs in the actual learning seems inconsistent, mainly because no rules/conditions are in place to motivate a consistent use of the ICTs. Certainly, such sporadic use of the ICTs in the universities has direct consequence on level of digital literacy skills among the students.

### 4.2.3 Adequacy of ICT infrastructure to support students' DLSs at SUA and UDSM

The current study is set on the premise that, the ability to maximize the returns of technology use is highest when every learner has equal and consistent access to adequate technology devices. Based on the aforesaid, the aim of this study was to answer a question *"How adequate is the basic ICT infrastructure to support students' acquisition of digital literacy skills for learning in Tanzania's selected universities?"*

The ICT infrastructure under this section are characterised into three categories, namely; Hardware, Software and technical and support services. The study sought to interrogate students' perception of level of adequacy for each of the infrastructure and services. The focus is to ascertain the locally acceptable ration between the available ICTs and the perceived demand in relation to the desired pattern of ICT use in place. The questionnaires employed Likert scale items with 1 to 5 alternatives to gauge the infrastructure aspects in Table 4.32a and 4.32b, whereas 1=Very poor, 2=below average, 3=Average, 4=above average, 5=Excellent.

***Table 4.32a: Adequacy of ICT infrastructure to students DLSs at SUA***

| | | ***Levels of perceived adequacy (N=321)*** | | | | |
|---|---|---|---|---|---|---|
| | ***Forms of Infrastructure*** | Very poor | Below average | Average | Above average | Excellent |
| i | Accessible Computers for use | 21(6.5%) | 39(12.1%) | 118(36.8%) | 76(23.7%) | 67(20.9%) |
| ii | Data & screen projectors | 10(3.1%) | 46(14.3%) | 119(37%) | 87(27%) | 59(18.4%) |
| iii | E-resources database | 38(11.8%) | 67(21%) | 116(36%) | 67(21%) | 33(10%) |
| iv | Internet in campus | 25(7.8%) | 53(16.5%) | 121(37.7%) | 68(21%) | 54(17%) |
| v | Internet off-campus | 78(24.4%) | 64(20%) | 87(27%) | 60(19%) | 31(10%) |
| vi | Access to e-contents | 56(17.4%) | 58(18%) | 111(35%) | 67(21%) | 29(9%) |
| vii | Power/electricity | 24(7.5%) | 52(16%) | 94(29%) | 85(26.5%) | 66(20.5%) |
| viii | Technical support (installations etc.) | 37(11.5%) | 59(18%) | 123(38%) | 58(18%) | 44(14%) |
| ix | Trainings for basic computer applications | 26(8%) | 34(11%) | 121(38%) | 68(21%) | 72(22.4%) |
| **x** | Trainings of the features of LMS (Moodle) | 38(12% | 69(21.5%) | 117(36.4%) | 65(20%) | 32(10%) |

Source: Field data-SUA (2021)

**Table 4.312b: Adequacy of ICT infrastructure to students DLSs at UDSM**

| | | *Levels of perceived adequacy (N=325)* | | | | |
|---|---|---|---|---|---|---|
| | ***Forms of Infrastructure*** | Very poor | Below average | Average | Above average | Excellent |
| i | Accessible Computers for use | 19(5.8%) | 50(15.4%) | 97(29.8%) | 71(21.8%) | 88(27.1%) |
| ii | Data & screen projectors | 19(5.8%) | 53(16.3%) | 94(28.9%) | 88(27.1%) | 71(21.8%) |
| iii | E-resources database | 26(8%) | 62(19.1%) | 102(31.4%) | 65(20%) | 70(21.5%) |
| iv | Internet in campus | 21(6.5%) | 44(13.5%) | 93(28.6%) | 68(20.9%) | 99(30.5%) |
| v | Internet off-campus | 78(24.4%) | 64(20%) | 87(27%) | 60(19%) | 31(10%) |
| vi | Access to e-contents | 56(17.4%) | 58(18%) | 111(35%) | 67(21%) | 29(9%) |
| vii | Power/electricity | 24(7.5%) | 52(16%) | 94(29%) | 85(26.5%) | 66(20.5%) |
| viii | Technical support (installations etc.) | 37(11.5%) | 59(18%) | 123(38%) | 58(18%) | 44(14%) |
| ix | Trainings for basic computer applications | 26(8%) | 34(11%) | 121(38%) | 68(21%) | 72(22.4%) |
| **x** | Trainings of the features of LMS (Moodle) | 38(12% | 69(21.5%) | 117(36.4%) | 65(20%) | 32(10%) |

Source: Field data-UDSM (2021)

### 4.2.3.1 ICT Hardware

The ICT hardware in this discourse include the publicly accessible computers, data projectors and sound systems in lecture rooms and laboratories which support students' use of ICT for learning. ICT hardware gauged under this section are particularly computers with locally acceptable memory and storage capacities and their augmented components and peripherals that provide sound, graphics, and video (Table 4.32a (SUA) and Table 4.32b (for UDSM)).

The descriptive data for SUA in Table 4.32a shows that, 21(6.5%) rated the adequacy of computers as very poor; 39 (12%) rated it as below average. That makes a cumulative minority (19%) who rated the infrastructure adequacy as generally below average. The other 76 (23.7%) and 67 (21%) rated the adequacy of accessible computers as above average and excellent respectively. This marks a cumulative

majority (45%) who generally consider the adequacy above average. A relatively large other percentage (36%) rated the adequacy of accessible computers for use as average. The descriptive data here suggests that, SUA has ensured the availability of computers to allow for a minimum computer use activities to take place. While this is commendable given the budgetary constraints, students who rated the adequacy as below average and average indicate that, much is still desired to ensure the acceptable computer-students ratio to foster its regular use and operational skills.

The researcher's observation noted that, SUA has three computer Laboratories with capacity to accommodate 60, 80 and 120 users respectively. In most cases, such computer laboratories are mainly used for scheduled teaching sessions (theory and practical) for all computer related units/subjects across university. During FGDs, some students highlighted the concern that they neither have time for private learning nor use of the computers in the laboratories because the labs are under timetabled sessions. Students confirmed that, they cannot schedule their private use of the computer laboratories. For instance, one member of FGD remarked that: "*You touch a university computer when it is a time for computer class"* (First Year female student BIRM-SUA: February, 2021).

Students were further asked to explain ways they compensate for the gaps with regards to inadequate access to computers at university. While some students opted to ask their parents/caretakers to purchase personal computers, those without such parental support tend to borrow computers from friends and/or do their work from cyber shops around the university. One respondent asserted that:

> *I had to ask my parents to buy me a computer! I started going to the computer lab with my laptop because we sometimes had to fight for a computer as everyone struggled to follow what the teacher was demonstrating* (2nd Year Male student-BSc. Ed-SUA: February, 2021)

> *I stopped thinking about the computer labs because you do not have time to work there comfortably. If I have a work to type, I normally book a computer at the cyber and do my work there. It's good there because you also get some support like formatting* (3rd Year Female BSc. AEA-SUA: February, 2021).

SUA has over 14,250 students (undergraduate and postgraduate) in total. Given the 260 computers in place, it implies a computer-students ratio of 1:53, contrary to the recommended ratio of 1:10 under normal circumstances (Kashorda and Waema, 2014). The study finds that, since students tend to use the available computers at different times, the available computers at SUA can support a reasonable number of students, of course if the available computers are functional.

The descriptive data for the adequacy of computers at UDSM Table 4.32b show that, 19(5.8%) students rated the adequacy of computers as very poor; 50(15.4%) rated it as below average. A total of 97(29.8%) respondents rated the infrastructure adequacy average. The other 71(21.8%) and 88(27.8%) rated the adequacy of accessible computers as above average and excellent respectively. The data makes 21.2%, 29.8% and 46.9% of respondents rated the adequacy of accessible computers as below average, average and above average respectively.

UDSM's main campus had over 22,000 undergraduate students by 2020, with female composition of 44.2% (UDSM, 2021). Its computer capacity in different units (about 400 in total) defines a computer-students' ratio of around 1:60. Although the ratio seems below standards (eg (Kashorda and Waema, 2014), the fact that some students have personal computers and others can access computers in cyber cafés may be used as alternative for students who may not wish to make use of university computers. This is also in line with the view that:

> *We have not had serious cases of students who cannot access computers for use. Computers are distributed to different academic units; in fact many others are located in the libraries where students*

> *have access to. Again, almost every student has a computer; that makes the available computers to be adequate for our students' use (Support Unit 3 UDSM: March, 2021)*

Qualitative data based on students' voices indicate that, students are aware of the computer availability in libraries but do not make substantial effort to use them. During the FGDs, some of such students claimed to have no access to computers for use, but had no idea that there are computers in libraries: "*Many of us do not have a computer, and therefore cannot manage a regular computer uses/practices"* (Male student, BCA-UDSM: March, 2021). Some students, on the other hand, indicated that, they preferred to use their personal computers over the university computers, of course due regular accessibility and flexibility. *"I have my personal computer; I choose when and where to work without causing inconvenience to others who may prefer to use computers provided by the university"* Female student-BA. DS, UDSM: March, 2021).

The study finds that, the computer capacity for both SUA and UDSM can support a good deal of students' use and acquisition of digital literacy skills. However, students who cannot afford their own computers are seriously limited to learn and make a productive use of the computers provided by universities because of limited accessibility, especially among students who reside off campus.

At SUA, the descriptive data (Table 4.32a) show that, a cumulative 17.4% of students rated the adequacy of data projectors as below average; 119 (37%) rated it as average and a cumulative 45.4% rated it above average. The descriptive details show that, majority (over 45%) perceives the adequacy as above average; followed by those who perceive the same as average (37%). Comparatively, the data at UDSM (Table 4.32b) show that, a cumulative 82(22.1%) student respondents rated the adequacy of

infrastructure below average; 94(28.9%) rated it as average and a cumulative 159(48.9%) rated it above average. The descriptive details show that, majority (over 48%) perceives the adequacy as above average; followed by those who perceive the same as average (28.9%). The data pattern provides an impression that, data projectors are on average adequate to support classroom use (by instructors).

The FGDs based on the two cases indicate that, the available projectors (PowerPoint Projectors) are rarely meant for students' use, but for instructors. This means that, students' use of projectors like PPT is uncommon in the selected universities because such tools are normally scheduled for instructors' use; and students' uses are restricted to sessions guided by instructors. In such conditions, it is uncommon for students to get the equipment for use in learning tasks without instructors. This further implies that, students do not have adequate time to learn and rehearse to master the use of such equipment.

> *I was embarrassed when the presentation we designed couldn't play with the projector our lecturer brought to class. We decided to abandon its use and rather make verbal presentation without the PPT* [3rd female BSc. Human Nutrition Programme]

> *Our lecturers never insist on the use of PPT for students' presentation: I think they are aware that the available facilities cannot support its use for all students* (2nd Year male Class representative BIRM–SUA: February, 2021).

> *I learned the basic use of PPT when one of our teachers brought the equipment to class. That was the only easy way to access the equipment because I don't think I can, otherwise, have access to* (3rd Year Female BA. Ed. UDSM: March, 2021)

The findings here connect with the earlier observation under this study, where students perceived their skills to design and use PPT as limited. The findings indicate a positive association between students' access to facilities and the mastery of using such facilities.

The findings in the two universities further show that, despite the availability of projectors at least for instructors' uses, some limitations seem to compromise the consistent availability and use in teaching and learning. For example, a significant portion of classes are overcrowded such that the projected presentations are not clearly visible for students sitting far back in lecturer halls/rooms. The projectors in some classes are not fixed and are moved from one class to another and time to time, making an inconsistent availability in such classes. This was also confirmed through interviews with ICT coordinators (at SUA) and students' FGDs (at UDSM), who indicated some concerns about pressure on the available resources which inhibits their consistent availability for students' use:

> *We have fixed projectors in some lecture rooms: Unfortunately, some classes have broken doors/windows, which make it insecure to have the facilities fixed in. We sometimes experience shortage of such equipment: The inadequacy is mainly caused by delays in repairs and procurement of the facilities* [Support Unit 2- SUA: February, 2021).

> *We rarely see instructors use PowerPoint projectors when they teach. For example, in my class, none of the instructors has used PPT. Many of the classes do not have support structures to place the projectors and smart boards* (Male 3rd year student BA.LIS-UDSM: March, 2021)

With regards to sound systems at SUA, 55(17%) respondents rated the adequacy as below average; 48(15%) rated it average and cumulative 218(68%) respondents rated the sound systems as above average. Taking a relatively similar pattern, 39(12%) respondents at UDSM rated the adequacy of sound system as below average; 94(29%) rated it average and cumulative 192(59%) respondents rated the sound systems as above average. The fact that majority rated the facilities' adequacy as above average, that suggest some confidence that such facilities relatively suffices the demand. However, as some of the students rated the facilities as below average and average that indicates some challenges the universities may still need to address.

#### 4.2.3.2 Adequacy of E-resources and Contents

The aim of the study was to find out the adequacy of electronic resources and contents the university has subscribed in to support students' learning. The review under this study noted that, SUA has subscribed to diverse commercial E-resources which offer substantial learning resources to students in various disciplines. Some of these include ScienceDirect, EBSCOhost, EMERALDS, and Resrearch4Life E-resources like AGORA, HINARI, OARE and ARDI. The university's main library further provides subject access to e-books, journals, theses/dissertations, research reports and other publications in agriculture, animal science, aquaculture, education, Engineering, Environmental Science, Forestry, Wildlife and Tourism, Information Science and Technology, Physical Science, Social Science, Veterinary and Medical Sciences and other multidisciplinary resources. Interested students and instructors with university-based email accounts can access the resources if they possess university-based email accounts. During an interview, Support Unit 2-SUA library affirmed that:

> *Access to e-resources is not a problem at the university because wireless access has been established at all major points within the institution, including Mazimbu Campus [a campus college of the university), such as the library, computer laboratories, classrooms and other premises.*

Like SUA, UDSM have subscribed to diverse commercial E-resources, including ScienceDirect, Ebscohost, emerald Insight, Willey Online library, Nature-Science and Education, Tylor and Francis Online, Springer Link, JSTOR, and Resrearch4Life and IMF library. The university's main library also provides subject access to e-books, journals, theses/dissertations, research reports and other publications.

The descriptive responses with regard to adequacy of the accessed e-resources and subject contents summarised in Table 4.32a & 4.32b show that, at total of 105 (33%)

at SUA rated the resources as below average; 116 (36%) rated it as average and a total of 100  31%) rated the resources above average. The data for UDSM shows that, 88 (27.1%) rated the resources as below average; 102(31.4%) rated it as average and a total of 135(41.5%) rated the resources above average. A slight difference comes out between the two universities, as a larger majority of students at UDSM perceive the adequacy of resources above average, followed by those who perceive it average and the least who feel it is below average.

However on the whole, the findings portray mixed perceptions over the adequacy of e-resources and subject contents at the university. Relatively large segments of respondents perceive the resources as below, average and above average respectively. The researcher deduces two perspectives based on the data pattern: First, some respondents may be ignorant of the availability of the e-resources; second, there may be issues with accessibility and resources' searching skills of the students. Some evidence emerged based on the following quotes:

> *The University of Dar es Salaam has invested significantly to ensure adequate access to e-resource databases relevant to every discipline in place. We now have another assignment to make the resources known to students. Not very many are aware of these resources* (Male Instructor and an Information Literacy resource person, UDSM. March, 2021).

An informal interview with library staff (coordinating the utilisation of e-resources) and FGDs with students indicated that, campaigns to raise awareness over the use of e-resources are part and parcel of orientation for freshers enrolled at SUA. The universities inform students during these programmes about the availability and potentials of various databases and subject-specific gateways hosted by the university library. SUA also use other platforms like posters, notice-boards, social media platforms and some training sessions to build awareness among students. Under prior

arrangements with library staff, interested students are trained either on individual or group basis. The observations are confirmed through the following quotes:

> *Despite the communications via university websites, emails and notes boards about the availability of e-resources and e-subject contents, there is low turn up on the use of these resources by both students and instructors* [Support Unit 3-SUA: February, 2021]

> *I normally go to the library to read the available books in shelves and if I want electronic materials I download from open sources (Google). I hear about the databases that we can access electronic materials; it's too complicated to search and access the materials you want* [Female 3rd Year, BSc. AnHP-SUA: February, 2021).

Similarly, the UDSM's Library services Unit is responsible for ensuring that both instructors and students have access to and use e-resources from various commercial E-resources the UDSM has subscribed to. The unit provides access and supports the use of the e-resources for both students and instructors. The study confirmed that, UDSM conducts a free Information literacy course to students, which embed access and use of e-resources skills among other things. Academic staff can also request for slots for their students to visit the library and learn ways to access and use e-resources and other digital contents. Despite this opportunity at UDSM, the study however noted that, students' less interest on the resources, limited support from instructors and management, power outages, and intermittent internet connection are some of the issues which limit students' skills to use the resources:

> *The library announces the availability of a course on access to and use of e-resources and digital contents to students and academics. In addition some academic staff request for slots to their students to visit the library and learn information literacy skills. As such, it is not a compulsory course to the majority of students. However, it is a compulsory course to students who are undertaking a library and information studies in their first year. To them it is a modular course and credited at the end of the semester (it is called LIS 102: Information literacy) (Support Unit 3UDSM. March, 2021).*

> *The university is well equipped with ICTs, with fast internet connection and subscribed electronic resources. However, the bottlenecks that*

> *face the courses include power outages, intermittent internet connection, the courses not being part of the mainstream ones with little support from academic staff, low levels of reading culture among students, missing strong link between the library and associated units, especially the ICT management office and giving such courses low priority* (Support Unit 3 UDSM. March, 2021).

Based on both the descriptive and qualitative data from diverse respondents, the researcher conceives the following findings: The University has subscribed to relatively adequate e-resources and e-contents for the subjects/disciplines in place. However, the problem may not be the inadequacy of resources, but lack of appropriate searching skills and awareness among students. The data suggests that, measures to raise students' awareness (marketing) for the potentials and use of e-resources, such as the use of posters, notice-boards, social media platforms and the training sessions have not brought the desired impact as the utilisation of the resources remains low. Similar to Mungwabi (2018), the current study finds it imperative that instructors champion the roles of advocating for the use of the resources because they can easily justify a connection to the learning tasks

Further qualitative data indicate a limited understanding of what e-resource databases are. Some students associate these resources with the electronic materials freely available on Google. Students however conceive that, they are challenged by internet connectivity from accessing the resources: *"There are plenty of materials online; we sometime rely on teachers' hand outs because it is costly to use internet"* (Female 2nd Year student: BA Development Studies-UDSM. March, 2021).

Further reflection of limited awareness draws from interview data from SUA Library staff:

> *The amount of time during freshers' orientation period on library use is inadequate; and unfortunately, when other training programmes are organised, they are usually on voluntary basis, normally attended by few undergraduate students. We are, of course aware that, the use of*

*IP address tend to account for the current low usage of some of the e-resources because the e-resources can only be accessed through an IP address* (Support Unit 3-SUA. February, 2021).

#### 4.2.3.3 Internet Connectivity in and off-campus

It is unrealistic to talk of learning environment for universities in the 21st century without internet. Internet is a tool for sharing information, connecting millions of computers together globally and networking (Sharma, Kumar & Thakur, 2011). Such role of internet makes it a powerful enabler of learning in ICT environment. Internet enables students to access and download e-resources, create and upload assignments, and participate in LMS mediated collaborative works**.** The current study sought to confirm the adequacy of internet service as an environmental requisite for students' learning in ICT environment. Based on the 5 points Likert scale, students were asked to provide their perception of adequacy of internet in relation to the actual learning tasks at university.

##### 4.2.3.3.1 Adequacy of Internet in Campus

This consists of all the students' sources of internet offered by the institution. This includes all Wireless Networks (WAN) and the Local Area Network (LAN). The descriptive data with regard to students' feeling on the adequacy of internet in campus (Table 4.30a & 4.30b) show that, a total of 78 (24.3%) respondents rated it below average; 121 (37.7%) rated it average and a total of 122 (38%) rated it above average. The descriptive data generally shows that, majority of the respondents (38%) rated the adequacy of internet above average. The almost equal segment (37.7%) also rated it average.

At UDSM, 65 (20%) respondents rated the adequacy of internet below average; 93(28.6.7%) rated it average and a total of 167(51.4%) rated it above average. The

descriptive data generally shows that, majority of the respondents (51.4%) rated the adequacy of internet above average. Although the descriptive data indicates a relative adequacy for in campus internet connectivity, some qualitative data indicates that, the internet is strong in some areas like library, administration building and a few classrooms and weak or inaccessible in many areas of university campus, including students' hostels:

> *We mostly use personal internet because the university offered internet is not accessible in many areas of the campus. So it is not reliable if you have some serious works to do* (Male 2nd year student, BCA-UDSM: March, 2021).

The data shows that, on the whole, the adequacy of internet range between average and above average. This indicates a mixed experience on the adequacy of the internet on campus, such that, some are comfortable but others may be experiencing slow and unstable connectivity. Although the universities in Tanzania (including SUA) are inter-connected to the national fiber backbone network (Mtebe & Raphael, 2018) further investments may be required to improve the network infrastructure in order for all students to explore the internet potentials for learning.

The data based on FGD with ICT coordinators (SUA) and interview with IT manager (UDSM) further indicate that, while SUA has a bandwidth supply of 100 Megabytes (Mbps), UDSM has a bandwidth supply of over 300 Mbps. Based on the recommendation for the bandwidth of 4mbps per 1000 students in campus (cf. Kashorda & Waema, 2014), the bandwidth supply at SUA can serve up to 25,000 users population while that of UDSM can serve up to 75,000 users. In other words, the available Bandwidth supply at SUA explains 4mbps per 500 users, and 4Mbps per around 200 users, a bigger bandwidth quota to guarantee higher connection and quicker upload and download of information, under normal circumstances (Sharma,

Kumar & Thakur, 2011). The interview data contradict the students' descriptive responses, whose majority rated the connectivity below average. A possibility may be that, some (few users) may be consuming the majority bandwidth, a common feature in situations characterized by unmanaged bandwidth use (Sharma, Kumar & Thakur, 2011). This suggests that, universities may be required to work on distribution of infrastructure and ensure an equitable management of bandwidth across users.

#### 4.2.3.3.2 Adequacy of Internet Off-campus

Students are increasingly forced to off-campus accommodation services because universities' hostels can no longer contain the growing numbers. While this presents a pressure-relief on some university infrastructure (eg. internet and electricity among others), students have to pay for such services from their own pockets. The internet option students use out of campus is mainly cellular Wi-Fi, offered by Mobile companies, which in Tanzania include (but not limited to) Vodacom, Airtel, Tigo, Halotel, TTCL, and Zantel networks. Students must have a smartphone or similar mobile device to navigate this form of internet. As such, the adequacy of internet may depend on quality of the device and internet bundle a student can afford. It further determines the convenience at which a student can utilize the e-resources and participate in collaborative learning opportunities offered by ICTs.

Data on students' experience of adequacy of internet connectivity for learning in their times off-campus at SUA (Table 4.25a) show that, 78 (24.4%) and 64 (20%) respondents feel the internet as very poor and below average respectively. While 87 (27%) view it as average, 60 (19%) and 31 (10%) respondents view the adequacy of internet as above average and excellent respectively. The data show that, majority (44.4%) view the adequacy on internet as below average compared to 29 % who see it

as above average. At UDSM (Table 4.25b), 144 (44.4%) respondents feel the internet as generally below average: While 87 (27%) view it as average, 91(29%) respondents view the adequacy of internet as above average.

The impression based on the data suggests that, the off-campus connectivity is on average adequate to support students' participation in ICT supported learning tasks. However, it also comes out clearly that, majority of students may not be able to realize the potentials of mobile supported internet, which is the alternative source off-campus, because they cannot afford the internet devices and data packages for regular internet use. The data show that, despite the mobile penetration of up to 80% and decreased price for mobile devices to US$30 (TCRA, 2018) many students are still unable to purchase data bundles and devices to support academic operations (Mtebe & Raphael, 2018). This suggests that, students who depend on mobile internet option continue to face difficulties to learn with ICTs due to inadequate internet as justified through a clamor from students' FGDs:

> *With the new Tanzania Communications Regulatory Authority (TCRA) regulations, the price for Internet bundles has gone so much higher than before, for example, with roughly 1 USD, you get 2 GBs which expires within 2 days. This is too expensive for us students because it means one needs about 15 USD in a month time for internet (*Classroom representatives-SUA: February, 2021).

The findings for the current study connect with Internet Society (2017) report for Africa. The report comprehends that, despite the promises and significant penetration of mobile phones across the continent, a comprehensive off-campus learning which is supported by mobile internet has not taken off in Africa. The major bottlenecks in this region include high communications costs, low bandwidth, low penetration of smart phones and the absence of locally relevant applications on mobile devices. Similar findings were observed by Marwa and Mushi (2018) for non-campus based students

of Open University of Tanzania in Dar es Salaam regions (Ilala, Temeke and Kinondoni). Based on the focus of this study, the amount of time students spend off-campus will increase the likelihood of their delayed acquisition of key skills to navigate ICT supported learning. As such, the government of Tanzania has a role to support universities to ensure that, both campus and off-campus students can participate in internet enabled learning tasks, which include the navigation of repositories and e-resources databases.

#### 4.2.3.4 Adequacy of Power (electricity)

Availability and assured power is a requisite for the use of ICTs and therefore students' acquisition of the key digital literacy skills (Armey & Hosman, 2015). In the discourse of this study, the use of computers, Learning Management Systems, public address systems, data projectors and internet search among others are all electricity driven. The current study sought to confirm if power supply is adequately ensured to guarantee uninterrupted students' learning and use of ICT in classrooms, laboratories and workshops. The data show that, the university is supplied with electricity power from national grid, and in addition has other sources namely solar and standby generators. These additional sources of power may be used as standby power back up at times of blackout. A participant for FGDs with ICT coordinators reiterated that:

> *Standby generators are located for the main administrative building and health center. We have solar power systems installed to support some computer operations in the library and computer laboratories. However, all these sources do not connect to many of the lecture and seminar rooms (*Support Unit 2-SUA: February, 2021)

> *Some lectures are disturbed when power goes off. This is especially in lecture halls/room which are not connected to the standby generators or solar system and have many students which require the use of public address systems or/and PPT presentation equipment (Male student, BRD-SUA: February, 2021).*

Students were asked to rate the adequacy of the available power to support ICT supported learning activities. The descriptive responses at SUA show that, 76(23.5%) students rated the adequacy of power below average; while 123(38%) and 151(47%) respondents rated the service as average and above average respectively. At UDSM, 66(20.3%) students rated the adequacy of power below average; while 77(21.8%) and 188(57.9%) rated the service as average and above average respectively. The researcher noted at UDSM that, hostels and many classes are not connected to standby generators, which suggests that, any ICT supported learning activities can be easily interrupted by power outage. This was confirmed through students FGDs, which revealed experiences of some confusion resulting from power outages: *No, many of the classrooms are not connected to standby generators; this includes some laboratories* (Male 3rd year student, BSc. Civ Eng. UDSM: March, 2021).

Further, the findings show that, although majority feel the supply of power above average, others who rated the service as average and below average indicate some pending challenges the universities must address. The emerging reason is, the coverage of alternative power sources is not comprehensive, such that an outage of grid based power results to suspension of a number of ICT mediated learning activities.

#### 4.2.3.5 Adequacy of ICT Technical Support Services

In the context of this study, these are specialised skills' personnel who can support a student to learn the use of ICTs for learning (Salim & Siddiquah, 2017). These entail services like installation of computer hardware and software, enhancing performance of computer systems, antivirus protection and fixing of internet signal problems, among others (Nalaila, 2015). The study sought to investigate the availability and

adequacy of such support accorded to students to support comfortable use of ICTs for learning. Qualitative data based on FGDs with students and ICT coordinator groups at SUA indicate mixed perspectives. Data from ICT coordinators show that, the university has technical office to support students on aspects including practical lessons in computer laboratories, how to navigate e-learning platforms, maintenance and installation for university computers. Students can access these services for personal ICT devices at some cost, of course lower than those from private vendors. However, limited university manpower makes this option unreliable because they must first fix issues for university staffs. Moreover, there are shops where private vendors in the university premises and in the township offer commercial support services for personal ICT devices and needs including trainings at some costs. However, these are commercial services, such that some students cannot afford their cost.

> *There are two groups of technical support teams; a team of university employed personnels and private vendors located in one of the university's building. The university technical team offer support to students during computer related courses in computer labs and to academic staff on ICT operations connected to their roles at university. Another team of private vendors available at the university offers private/personal ICT support services* (KI 1-SUA: February, 2021).

> *There are many technicians within the university premises; they can fix almost all computer related issues if one has a computer. Yes, their services are costly because they are doing business!* (Female 2nd year student: BIRM-SUA: February, 2021).

The descriptive data with regard to adequacy of technical support at SUA based on students' questionnaire show that, 96(29.5%) respondents rated it below average. This indicates a dissatisfaction of higher level. About 123 (38%) respondents rated it as average, which indicates an average satisfaction; and a total of 102 (32%) others rated it above average, indicating a relatively higher level satisfaction. At UDSM 88 (27.1%) respondents rated the adequacy of technical support below average; 99

(30.5%) respondents rated it as average and a total of 138 (42.5%) others rated it above average.

While majority of the respondents at SUA feels the technical support as average, followed by those who see it as above average, the least conceive it below average. Otherwise at UDSM, majority of respondents perceive the adequacy of the technical support above average. This slight difference between the universities suggests that, UDSM has a higher penetration of commercial technical support because of its location in the largest commercial city Dar Es Salaam. The data suggests that, students in the two universities have options for technical support which guarantee the required support and the desired technology use. However, some students who are forced to own personal computers cannot afford the private vendors' costly support. As such, the university option of technical support remains an imperatively reliable and friendly for students, majority of whom come from limited income households. Besides, for example, a university may acquire laptops to be borrowed by students who cannot afford costs associated with personal laptops (Mngwabi, 2018).

#### 4.2.3.6 Adequacy of Trainings on operational Aspects of ICTs at SUA and UDSM

##### 4.2.3.6.1 Adequacy of Trainings on basic computer operations

The focus of the study is based on the importance attached to role of computers for improved learning and preparation for careers along which computers have become a necessity. It is conceived in this study that, students who use computers learn to use word processors for typing works, search materials from databases and websites, use internet to work collaboratively and subsequently strengthen grammatical skills among other things (Wright, nd). The aim of the study was to confirm the adequacy of training the university provides to support students' computer operational literacy.

The scope of trainings targeted under this section includes compulsory and voluntary forms of training organized by university authorities for a student. The adequacy is therefore gauged based on respondent's self-perception of the extent to which such trainings have been helpful to learning with ICTs at university.

Students' were asked to confirm for a subject (if any) which primarily train them on the use of ICTs for learning. Out of the 321 student respondents at SUA, 282 (88%) confirmed the presence of such subject; while 10 (03%) said there is no such subject. Otherwise, 29 (9%) are not sure whether there is or no such subject. Students who confirmed the presence of a subject further identified *Basic Computer Application (CIT 100)* as a course/subject dedicated to orient them on the use of ICT for learning. The data at SUA therefore confirms the presence and students' awareness and connection between the subject on one hand and the expected outcomes (digital literacy skills) on the other hand.

On the other hand, out of the 325 student respondents at UDSM, 121 (37.1%) confirmed the presence of such subject; 108 (33.2%) said there is no such subject. Otherwise, 96 (29.5%) are not sure whether there is or no such subject. Unlike the data for SUA, the responses at UDSM present majority of students who cannot recall a subject which orients their use of ICT for learning. Students who confirmed the presence of a subject further identified several names of subjects, which include Media and Technology, Technical Basis of Communication, Computer programming, Management Information System, Computer Literacy for teachers, Information Studies, Computer studies, Computer for Engineers, Computerized accounting, Introduction to ICT and; Information Technology and Information Systems. This suggests that, although there seems subject(s) which provide some basics of

technology use for learning, many students are struggling to recall such subject(s). This may imply that, (if any) the subjects designed to foster general ICT skills have not had memorable impact.

The primary assumption under this section is that, the presence of a subject is one thing; and subjects' capability to transform students' use of ICT in learning (which is a crux of this study) is another one. Major considerations here are on "*what to teach* and *how to teach".* The study reviewed the course syllabus for the subject (CIT 100) in order to evaluate the balance of contents in relation to the skills' framework adopted (UNESCO-IS, 2018). The study observed that, the course contents (what to teach) cover both operational and informational attributes of digital literacy skills. However, some aspects of informational skills do not feature clearly in the course contents, for example, information management, evaluation and sharing/reporting information safety. The course/unit topics cover the following topics:

> *Computer basics and its generation; Basic hardware components and their functions; Major operating systems and basic usage of their services; Word processing Skills (eg. create, format and edit word documents); Presentation, interpretation and analysis of data using spreadsheet; Basic internet concepts, World Wide Web and their applications; Computer Security Issues* [CIT 100 Course Contents].

Besides, the review of course syllabi for the identified courses at UDSM noted that, the course contents for majority of the subjects cover mostly operational digital literacy skills, except for the subject taught to students pursuing Bachelor of Library and Information Studies. As such, just like for SUA, the aspects of informational skills do not seem to have been a priority.

Further review of syllabi for the subjects said to support students' use of ICT for learning reveals that, despite the missing of aspects on informational literacy, the course contents cover some critical aspects of digital literacy skills. However,

classroom observation on the "*how to teach"* dimension reveal some challenges as the lecture sessions for the course are crowded and have limited practical sessions. Students continued to capitalize on the use of lecture handouts which they believed to guide preparations for tests and examinations. The data further show that, the course curricular are not designed to train students on how to apply what is taught rather for answering examinations. The following statements featured in several FDGs with students:

> *We do not have time for practicals… sometime we conduct tutorial sessions in a normal classroom (not computer lab) and either none or few of students have personal computer: Some questions in the test/exam want you to imagine you have a computer and some of us have never touched a computer (*Female 1st year student BSc. AnHP-SUA: February, 2021).

> *What is found in the course is not something new! I trained the same contents prior to university enrolment. The difficulty part is that, this subject is something I have to read in order to answer examination* (Male 3rd Year student. BRD-SUA: February, 2021).

> *I learned the computer course in first year, yes; we used to treat the subject just like other subjects: What matters in the end is that, one must pass the exam. No one examines you if can type assignment; like to date, am in final year, but I tell you very many students in my class cannot type their assignments; they expect some other people to type for them* (Female 3rd year BCA. UDSM: March, 2021)

Descriptive data about the adequacy of trainings on basic computer application as presented in Table 4.32a show that, 70 (19%) respondents at SUA consider their skills below average; 123 (38%) consider it average and 140 (43.4%) consider it above average respectively. Based on the data, majority of respondents rate the trainings above average. They are confident that the trainings have built their skills to operate computers, which is one critical requisite to learning with ICTs. Other 38 % and 19 % who conceive the training as average and below average portray a challenge for a university to sustain the trainings by critically reflecting the diverse needs of all students including those with limited ICT background.

At UDSM (Table 4.32b), 91(28%) student respondents consider the adequacy of trainings on basic computer application below average; 88 (27.1%) consider it average and 146 (44.9%) consider it above average respectively. Based on the data, majority of respondents rate the trainings above average and are confident that the trainings have built their operational skills of a computer. Other 27.1 % and 28 % conceive the training as average and below average, which suggests that, they are relatively less confident to operate computers or similar devices to carry out learning activities.

#### 4.2.3.6.2 Trainings on the features of Moodle Learning Management System

The study observed that, SUA installed Moodle platform to manage ICT mediated teaching and learning. Moodle is software with features that can facilitate various on-line teaching and learning activities; such as sharing asynchronous video and other academic materials, creating contents online, online discussion, chats, and students peer review, online assignment/quizzes and self-assessment of submissions among others (Nalaila, 2015). The current use of the Learning Management system for teaching and learning at SUA is still at infancy stage and it is generally still underutilized. The dominant activities mediated by the system are mainly uploading reading materials (like lecture handouts), course outlines, CAT and examination results, sharing of announcements. SUA has yet structured mechanism to evaluate the level of LMS use and the nature of activities carried out through the system.

The study made further attempt to find out evidence for adequacy of trainings (if any) to orient students on the system use and if such trainings have any impact to how students learn with the system. The study noted the following approaches through which students are oriented to use LMS features for learning: Firstly, one day (during

the orientation week) is dedicated for fresher students to understand Moodle and e-learning at university. Some sessions are organized for smaller groups of students per programmes. However, a one day time allocated to train students on the Moodle use is inadequate for them to master its use. In addition, the timing makes it difficult for students who are unaware of the nature of learning practices at university to understand the system use. Secondly, in course of using the system, instructors for a particular course are expected to guide students on the use of features related learning tasks. However, as the usage of Moodle among instructors is still low, instructors may not be prepared to use the system and therefore cannot offer such guidance to students. Thirdly, students are advised to seek support at University's Centre for ICT (CICT) for any technical challenge about the system. As much as it may be a workable approach, it closely depends on the earlier approaches. Based on the challenges associated with the identified approaches, the study finds that, the approaches are theoretically viable; they are however fragmented to support students' effective use of the system.

An informal discussion with instructors who teach Computer Application Course (CIT 100) revealed that, the university does not have regular and sustainable arrangements to orient students on the LMS use. The response confirmed that, majority of instructors still perceive the system as new and therefore cannot offer a significant support for students to use it: "*The computer application course we teach does not include aspects on LMS use…. Instructors feel the system is new, therefore not many are making a comprehensive use"* (Instructors for CIT 100 Course-SUA: February, 2021).

During FGDs with students on impact of the approaches to train LMS use for students, it emerged out that, the orientation week is only used to introduce the system

(by name and its functions). Details on how the system is used are too superficial for one to make a practical sense out of it. For example, one student reiterated that:

> *The orientation week was not meant to train us to use the system. I think they only meant to make us know about the availability of the system. We were told we shall learn and practice through classroom activities* (Female 1st year student- BSc. AnHP-SUA: February, 2021))

Further data indicated the need for trainings to be placed in the context of teaching methodologies, subject contents and learning tasks. Subject instructors are the perfect agencies to train students on the system use because they can connect to subject contents. Based on this view, the university must support instructors to conceive the system in line with the pedagogies in context: "*Although the CICT staff can help you on one-to-one basis in terms of ways to use the system, it is difficult to contextualize what is required about the course contents"* (Male 2nd year student-BIRM-SUA: February, 2021).

Students' descriptive data to justify the adequacy of trainings particularly on the features of Moodle LMS show that, 107 (33.5%) rated it below average; 117 (36.4%) rated it average and 97 (30%) rated it above average. The data show that, majority of respondents at 36.4% rated the trainings as average, and followed by those who view it below average and the least above average. This is in line with the qualitative data based on interview and FGDs that, students have different feelings about the adequacy of the training on features of Moodle system. The data pattern suggests that, majority of students is still struggling to navigate the system. They are consequently likely to take longer to master the system use and display authentic learning.

At UDSM, instructors who are interested with the use of the platform are trained by staff from the Centre for Virtual Learning (CVL) on the features, uses and how to access students through the system. However, no training exists for students,

confirming that, their mastery and use of Moodle LMS is a function of self-initiatives and guidance of instructors' based on learning tasks. The CVL only provides link, usernames and defaults passwords to allow students to access the LMS features and learn the system on their own. There is an assumption that, "*students can learn and use the system effectively because the system is user friendly and simple to learn"* KI 1 SUA: May, 2021).

> *We don't train students; when instructors have uploaded contents in the Moodle, we only create usernames and default passwords for students. We expect that, a teacher will guide students to use the LMS features, tell them how to log in and; they normally manage because the LMS is too user friendly. We believe this student can use the system because it is similar to other platforms like emails, instagram and other platforms which students can do without training* (KI 1 UDSM: March, 2021).

The responses further show that, the instructor is impliedly tasked to ensure that respective students are taking the provided tasks in the system without committing any form of dishonest. Unfortunately, there is no mechanism for the instructor to check on student's participation in online learning tasks, which suggests that, dishonest or illiterate students can easily cheat (eg. free riders).

With regard to descriptive data based on Table 4.32b, 109(33.5%) rated it below average; 91 (28%) rated it average and 125 (38.5%) rated it above average. The data here indicate that, majority of students consider the available support adequate. This suggests that, some students have made personal efforts to learn the use of the system, and therefore appreciate the support given by their instructors. However cumulatively, over 60% are dissatisfied with the adequacy of trainings about the features and how to navigate the Moodle LMS. This is not surprising because the LMS at UDSM, of course just like SUA are still underutilized.

Previous studies in the context of SSA and Tanzanian in particular present an impression that, universities cannot support ICT mediated learning (Bhalalusesa, Lukwaro & Clemence (2013), Tedre, Ngumbuke and Kemppainen, 2010). However, it is still unclear of what the available infrastructure can support. In contrast, the impression based on the current study's findings show that, the universities selected for this study have made significant strides with regard to ICT infrastructure for learning (Mtebe & Raphael, 2018). A significant majority of respondents perceive the adequacy of various forms of ICT infrastructure as average and above average. Universities have even attained the desired standards for some ICT facilities; for example, both SUA and UDSM have attained the 4Mbps bandwidth per 1000 students in the campus as recommended by KENET (Kashorda & Waema, 2014). This suggests that, the available infrastructure already provides opportunities for students to acquire a substantial level of digital literacy skills, when other factors are in place. This suggests the need for a change of mindset, to appreciate and ensure comprehensive use of the already available opportunities.

Universities in Tanzania, just like in other SSA countries are challenged by budgetary limitation to design a high-tech environment for learning. Therefore, they are likely to encounter some difficulties to attain the acceptable level of adequacy of ICTs in a short run. Mtebe (2013) argued similarly that, the existing financial constraints make the procurement of adequate ICT facilities the most expensive. As such, universities have minimum level of ICT infrastructure to support the context specific uses and relevant level of students' skills to learn with ICTs. After all, some ICTs infrastructure and facilities, for example the features of Moodle LMS, e-resources databases and Social Networks, remain underutilized because of ignorance, limited awareness, interest and skills among students (Nzuki, 2014). This calls for universities

to skew their focus to promote necessary skills for both students and train instructors to support comprehensive uses of the available infrastructure.

Despite some challenges which characterize the inadequacy of ICTs, some ICT supported learning activities can take place. In fact, if managed properly, the available infrastructure suffices to mount significant types of students' learning activities and acquisition of substantial digital literacy skills. The study observed that, some programmes in the studied universities (eg. BSc. Education (Mathematics and Informatics) at SUA and Bachelor of Library and Information Studies at UDSM registered more use of LMS and e-resources respectively despite exposure to the same infrastructure. The current observation reflects the experimental study on causality relationship between ICT infrastructure and learning outcome in Vadodara (India) (Banerjee & Duflo' (2003). The cited study established that, positive outcomes can only be assured under controlled experiments (uses), where a group uses ICTs in a certain way as opposed to the equivalent group which does not. This means that, the use of infrastructure/facilities like internet bandwidth, computer laboratories, and e-resources need to be controlled and managed properly to guarantee sustainable use.

In a nutshell, the data, findings and discussion in this section have revealed mixed perspectives regarding the adequacy of ICT infrastructure in both Universities. Instructor and students' perception about adequacy of ICT infrastructure has influence on the actual use particular ICTs. The section provides a picture that, instructors and students do not appreciate and therefore unlikely to make comprehensive use that will lead to mastery of such ICTs.

### 4.2.4 Students' Prior ICT background and Digital Literacy Skills for Learning

The study sought to answer a question "*How does the prior ICT background influence the development of digital literacy skills for learning among students in selected universities in Tanzania?"* The purpose was to establish the implication for students' prior ICT background knowledge and on digital literacy skills for learning. Tanzania school system uses a 2+7+4+2+3+ structure. This translates to 2 years of pre-primary education, 7 years of primary, 4 years of ordinary secondary education, 2 years of advanced level secondary and a minimum of 3 years of university and tertiary education. At the ordinary secondary education level, the taught subjects are grouped into five categories, namely, Languages, Social Sciences, Natural Sciences, Business Studies and Aesthetics. The current fee-free basic education covers pre, primary and ordinary secondary levels. The secondary education is generally designed to prepare students for tertiary and higher education, vocational, technical and professional trainings (TIE, 2010). Information and Computer Studies as one of the subjects under Natural Sciences category, is meant to train students' ability to collect, process, exchange/share and present information. Such skills are further expected to help students participate efficiently in universities where ICT use is already transforming the teaching and learning practices (MoEST, 2014).

The current review has noted that, ICT remains an optional subject, not taught in majority of secondary schools with very limited exceptions for few private schools and public schools under some projects. Unlike those in developed countries, schools in Tanzania and other developing countries are yet to guarantee access to and use of technology for learning (Stati & Torres, 2020). Lack of ICT infrastructure, teachers with required competencies to teach students and poor connectivity include some of inhibitors of ICT learning and use (MoEST, 2014). Students have to make personal

arrangements outside formal school system to acquire the digital literacy skills for their post-secondary schooling. However, the differentiated arrangements to achieve this will certainly result into sporadic patterns of ICT use and consequently unauthentic learning (Selwyin, 2003).

#### 4.2.4.1 Students' entry Schemes in Tanzanian Universities

In Tanzania, the Commission for Universities (TCU) recognizes three schemes for entry into degree programmes: The direct entry scheme for holders of Form Six Qualifications and; the equivalent qualifications entry scheme (for holders of Ordinary Diploma or Equivalent Qualifications). The Foundation Programme of the Open University of Tanzania entry scheme provides for entry qualifications at the Open University of Tanzania (TCU, 2020). Students' from both public and private school systems have equal access to any of the accredited universities in the country. As such, SUA and UDSM were selected for this study because they both receive students of similarly diverse backgrounds. Therefore, the findings in this study represent insights from students of diverse backgrounds, which further serve to heighten content validity for this study.

Based on the questionnaire, students were asked to provide details about their school background and prior ICT experience. The aim was to establish the convenience at which students from such backgrounds adapt to university's ICT supported learning practices. Details about the students' school background entry schemes are given in Table 4.33:

**Table 4.32: Students' entry Schemes at UDSM and SUA**

| | ***UDSM (N=304)*** | | ***SUA (N=317)*** | |
|---|---|---|---|---|
| **Entry Scheme** | *Males%* | *Females%* | *Males%* | *Females%* |

| | | | | |
|---|---|---|---|---|
| Advanced Certificate of secondary education | 110 (47%) | 125(53%) | 158(55.6%) | 128(44.4%) |
| Diplomas and other equivalent requisites | 59(86%) | 10(14 %) | 25(81)% | 6(19%) |

Source: Field data (2021)

Data from SUA presents a total of 286 (90%) student respondents who were enrolled to the university based on their advanced secondary level entry requisites. Out of the aforesaid, 110 (47%) are males and 125(53%) females. A total of 31 others (10%) were enrolled based on their Diplomas and other equivalent requisites with 25 (86%) males and 6 (19%) females. At UDSM, a total of 235 (88%) student respondents were admitted based on their advanced secondary level entry requisites, with up to 110 (47%) males and 125 (53%) females. Otherwise, 69 (12%) others were enrolled based on their Diplomas and other equivalent qualifications with 59 (86%) males and 10 (14%) females.

The response pattern suggests a disproportionate representation based on entry requirement backgrounds of students. Majority of students were enrolled based on their advanced certificate secondary education background, whose curriculum treats ICT subject as optional. The findings are in line with Burns et al. (2019), that, primary and secondary schools in SSA do not have the physical, technical and human resources to support students' digital literacy skills. Therefore, one cannot take it for granted that students of such background can learn comfortably with the ICTs universities.

#### 4.2.4.2 Students' awareness about ICT use towards the entry to University

Under this section, the study sought to elicit details about students' awareness on the importance of possessing ICT devices (eg. computer) for learning; whether they had such devices and any experiences of working with the ICT devices towards the entry to university. This information was considered important to justify the preparedness of student to participate in ICT enabled instruction. At SUA, over 84% (271) of respondents were aware that, computer or similar device is one of key requirements for learning at the university. However, about 16 % did not consider it as important to possess such a device. Indeed, a total of 240 (75%) respondent students had one of/a such devices like computer, laptop, Ipad or smartphone. At UDSM, 217 (66.8%) respondents knew that, computer or similar device is one of key requirements for learning at the university. The rest 108 (33.2%) did not consider it as important to possess such a device. Indeed, a total of 203 (62.5%) respondent students had a computer, laptop or similar devices, while 112 (37.5%) did not possess such devices. The data show that, majority of students is aware of the importance of devices to support ICT supported learning. Many students declared that, parents, guardians or sponsors bought them the ICT devices:

> *My brother bought me a computer when I was in Form five (5). It was risky to have it in school but I used to learn its use during holidays. Later on he told me that, the computer was meant to support my university studies* (Female 1st year student- Mass Com-UDSM: March, 2021)

The study observed that, of all respondents who had the ICT devices at SUA, only 90 (38%) had a laptop at a ratio of 40, 31 and 19 for 1st, 2nd and 3rd academic years respectively. Similarly at UDSM, 107 (52.7%) students had a laptop, at a ratio of 43,

34 and 30 for 1st, 2nd and 3rd academic year respectively. The rest (46.3%) had smartphones, whose operations may be limited to certain learning tasks.

The data suggests two findings: One, a growing consciousness about the need to possess some ICTs for learning with time. Later (newer) student cohorts increasingly possess ICT devices which can mount comprehensive learning activities (eg. laptop), over others devices (like smartphones). Second, students' increased possession of ICT devices (like Laptops) towards university entry indicates a growing community-student support model for Digital Literacy Skills. As majority of students cannot afford the learning ICT devices, this challenges universities to put up and market networked computer laboratories to support such students with financial difficulties to own personal ICT devices. Otherwise, universities are challenged to re-configure their LMS to be accessible through mobile devices (Mtebe & Raphael, 2017).

The study further interrogated students' reflection of their prior computer experience and general digital literacy skills' level towards their entry to university. The aim was to explain any transitional challenges students encounter in order to justify their ICT use experience and any support needed to enhance participation in ICT supported learning. In the first instance, 71 % of students at SUA confirmed that they had taken some training/lessons related to computer or ICT use prior to university studies. Otherwise, 202 (62.2%) students at UDSM had taken some ICT training prior to university admission.

> *I took my ordinary secondary education at a private school called ZYZ [name hidden] where we had a computer laboratory with about 10 computers. We used to attend some training once a week. When I joined advanced secondary school we did not have opportunities to learn about the use of computer. Therefore I had some ideas about the basics of computer at my entry to the university* (Male 1st year student BSc. AnHP-SUA. February, 2021).

> *My father had a computer; I was learning its use during holidays. So when I got to university a computer was not something new to me but I needed time to learn the effective use for learning* (Female 1st Year student-BSc Ed-SUA. February, 2021)

> *With the computer uses at SUA, I only needed to learn the use of e-learning and other few things about the use of computer. I had the skills for operating computer because I had taken a certificate course on Basic Computer applications* (Male 1st year student-BIRM-SUA. February, 2021)

The findings imply that, 29 % and 37 % of student respondents at SUA and UDSM advanced to university level without any training in ICT use. Therefore, any level of ICT use for learning at university is a new experience for them. As such, they rely on the guidance or support the university structures can offer for their comfortable adaptation: "*I studied in ward secondary schools without computers for students. I touched a computer for the first time at University"* (Female 2nd Year student, BA. Sociology-UDSM: March, 2021).

> *I studied in private schools from form one to Form Six: Although there were computer classes in my ordinary level school, we were not forced to attend the classes because computers were few. When I joined my university studies, I noted some difference with my colleagues who attended the classes. They picked up very quickly on aspects like doing course registration* (Male 3rd Year student, BSc. ANREB-UDSM: March, 2021).

#### 4.2.4.3 Platforms for Prior ICT literacy among students at SUA and UDSM

The study sought to confirm the platforms from which students gained ICT experience/knowledge prior to university admission. The aim was to gain some understanding of how students of various ICT backgrounds acclimatize to university's ICT environment. Students were therefore provided with a checklist for them to indicate the source of their computer lessons/trainings, as presented in Table 4.34.

**Table 4.33: Platforms for prior ICT literacy among students at SUA and UDSM**

| | **SUA: N=227** | | **UDSM: N=202** | |
|---|---|---|---|---|
| ***Source of learning*** | *Freq.* | *%* | *Freq.* | *%* |
| Training by family members | 97 | 43% | 83 | 41% |
| Training by peers/friends | 134 | 59% | 109 | 53% |
| Studied in secondary school | 100 | 44% | 119 | 59% |
| A certification course in computer | 59 | 26% | 63 | 31% |

Source: Field data (2021)

The data based on Table 4.34 show that, students in the studied universities come from similar prior ICT environment and may be displaying similar transitional learning characteristics. A total of 97(43%) student respondents at SUA acquired some ICT training from family members and other 134 (59%) received some trainings from peers/friends. A total of 100 (44%) respondents learnt about ICTs from their previous secondary schools while 59 (26%) others had gone through some ICT related certification courses. At the UDSM, 83 (41%) and 109 (53%) indicated to have drawn their ICT knowledge from family members and friends respectively. Other 119 (59%) students learnt the basic ICTs in their prior secondary schools and 63(31%) others had taken some computer courses prior the university admission.

The findings indicate a perspective that, the multiplicity of sources of students' prior ICT knowledge is likely to cause variations in terms of what students know and the ease at which they can adapt the university learning practices. Based on the perspective, the government and any other collaborating institutions are challenged to create and sustain coordinated skills' acquisition programme(s) for ICT use across the school system.

#### 4.2.4.4 Students' prior ICT experience and confidence to learn with ICT

The study further interrogated the role of students' previous ICT experience towards university's ICT environment for learning. In this, students were required to either agree or disagree to whether their prior ICT experience gave them confidence to use ICTs in their learning tasks. The responses are presented in Table 4.35

**Table 4.34: Students' Prior ICT Experience and Confidence to Learn With ICT**

| | **SUA: N=233** | | **UDSM: N=202** | |
|---|---|---|---|---|
| *Responses* | *Frequency* | *%* | *Frequency* | *%* |
| Agree | 95 | 41% | 73 | 36% |
| Disagree | 126 | 54% | 119 | 59% |
| Not Sure | 12 | 5% | 10 | 5% |

Source: Field data (2021)

SUA responses in Table 4.35 show that, out of 233 respondents, 95(40.8%) agreed; 126 (53.9%) disagreed and 12(5%) were not sure. Besides, the UDSM responses show that, 73 (36%) agreed; 119 (59%) disagreed, but 10(5%) were not sure. Based on the responses, despite the prior ICT experience among some students, this has not contributed to their confidence to use ICTs at the university. The responses show that, majority of students with some prior ICT experiences struggle to integrate their knowledge with learning practices at university. The reasons for this deficiency include the impractical nature of platforms for training the students went through. For example, a repeatedly mentioned challenge of the computer trainings attended by students, one student claimed that:

> *I attended the computer course to avoid idle stay at home: I had no idea about how I was going to use the knowledge outside my personal computer operations; now here you have to do some activities, and lecturers mark!* (Female 2nd Year student; BSc. BSc. AnHP-SUA: February, 2021).

> *My previous Computer experience helped me to score B+ for the Computer application Course: But I really cannot make any*

> *comprehensive use of computer for my learning activities (actual computer use practices).* (Male 2nd Year student; PESS-UDSM: March, 2021).
>
> *Of course my prior knowledge gave me confidence especially with handling of my computer; I can update antivirus, clean the computer, managing the security of my computer and even search for information and do some typing: I also do the course registration for myself and for others because of my previous training. But it needs time to understand what teachers expect us to do with the technology* (Male 1st Year student, BCA-UDSM: March 2021)

The findings show that, students' prior ICT experience can be integrated to the learning activities at university. Ilomäki et al. (2012) study also confirmed that, experiences may have some insufficiencies such that universities must systematically address them to suit the learning practices in place. This in line with Pierroux and Kluge (2011) view that, out-of school ICT experiences and tools like online chat and messaging applications, file sharing, social collaborations can be enhanced through appropriate pedagogical design and digital technologies to support formal learning. Similar to the view by Handley (2018) for the OECD countries, this situation suggests that, universities must support instructors to guide students to adapt smoothly to the ICT experiences at university.

#### 4.2.4.5 Instructors' Perspective on Students' prior ICT Background

Not all communities have equal access to technology education due to the digital divide which inhibits some students' ability to develop the required requisites to use the technology (Stati & Torres, 2020). Instructors were asked to reflect on their experience specifically with first year students, and provide opinions on whether students enrolled to university studies have prior ICT background to support smooth transition to ICT supported learning at university. Responses are presented in Figure 4.5.

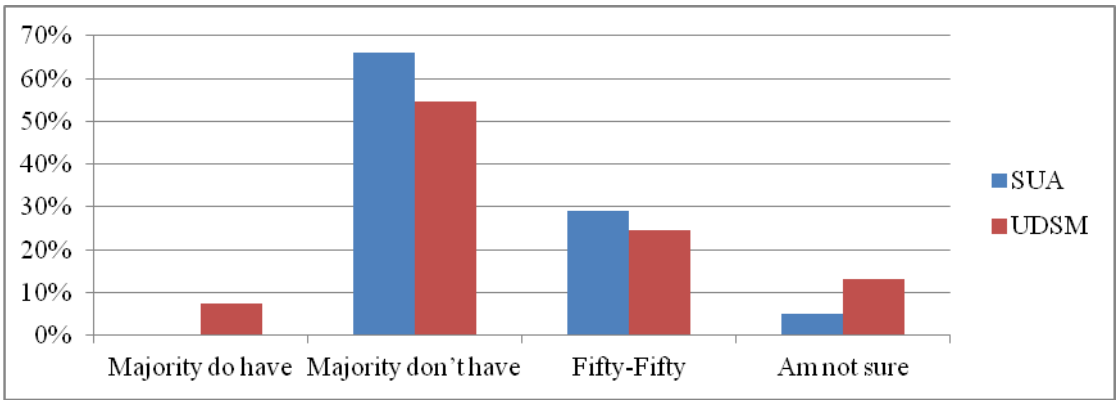



**Figure 4.5: Instructors' Perspective of Students' prior ICT background at SUA & UDSM**

Source: Field data (2021)

The responses for SUA (in Figure 4.5) show that, 41(66%) instructors perceive that, majority of the newly enrolled students do not have a background to support smooth transition to ICT supported learning at university: 18 (29%) instructors perceive that, about 50% do and 50% do not have such background. Other 3(5%) were not sure. At UDSM (Figure 4.5), 29(54%) respondents consider majority of new students without such background, followed by 13 (24.5%), who view the composition as 50/50. Despite a slight variation between the universities, instructors' view suggest, on average that, majority of students do not have good prior ICT background. This concurs with the students' perception of their own lack of confidence, as over 50 % indicated that, their ICT background was inadequate to give them confidence to learn in ICT environment. The findings further confirm that, students in the selected universities share similar background experience where ICT has not featured very well in the pre-university school system. The current findings confirm the observation of scholars like Burns *et al.* (2019) and Barakabitze et al. (2019) that, the pre-university ICT experience of students in SSA countries and Tanzania in particular is a serious challenge. Such attribute make them technologically ill-prepared to learn in

ICT environment unless they are subjected to systematic support mechanisms. According to Shopova (2014), young people who come to universities without study skills to operate in ICT environment are likely to develop superficial knowledge of ICT which actually do not contribute to improved learning. Based on the observations made under this study, students who transit to university require a lot of mentorship to enable them cope efficiently (Rahayu & Sapriati, 2018).

Instructors were further asked to outline any persistent features of the ICT use for the first year students that explain their prior ICT background. These attributes cited by instructors from both universities are presented as operational and informational dimensions in Table 4.36.

**Table 4.34: Disorders in ICT use among First Year students at SUA and UDSM**

| | | **Frequency** | | | **Frequency** | |
|---|---|---|---|---|---|---|
| | ***Operational disorders*** | SUA (N=62) | *UDSM (N=53)* | ***Informational disorders*** | SUA N=62 | UDSM N=53 |
| 1 | Cannot operate computers | 13 | 28 | Cannot observe ethics in writing | 31 | 40 |
| 2 | Cannot use window applications like word, spread sheets | 21 | 25 | Cannot design and use PowerPoint presentations | 28 | 17 |
| 3 | Cannot operate basic features of Learning Management System | 19 | 27 | Cannot type and format assignments | 40 | 34 |
| 4 | | | | Cannot integrate information (copy paste, cannot cite etc.) | 33 | 27 |
| 5 | | | | Issues with writing skills (eg. editing, proofreading) | 29 | 30 |
| 6 | | | | Lack of information searching skills | 27 | 31 |
| 7 | | | | Cannot filter and evaluate information | 31 | 26 |
| 8 | | | | Cannot write emails properly | 15 | 20 |

Source: Field data -SUA & UDSM (2021)

The findings show that, instructors' for the selected universities are aware of persistent features which confirm university students' poor ICT background. Scholars

like Crawford (2011); Mossberger, Tolbert, Bowen & Jimenez (2012) and Park & Jang (2016) attribute such an understanding as useful basis to bridge the gap between what the students do not know and what it takes for them to learn comfortably in ICT environment. As universities worldwide strive to transform the workforce to the desired skills, they are challenged to accommodate students' differential background to systematic models of learning in universities. In their roles, instructors are the best parties to support students' acquisition of the desirable digital literacy skills for learning. The current findings connect Meyers et al. (2013) and Ilomäki et al. (2012) which emphasize the role that instructors can play to bridging the gap between students' prior technology experience and the desired digital literacy skills for learning in universities (Sefton-Green et al., 2016).

Some characters point out serious challenges of sub-standard education in both primary and secondary education provision in Sub Sahara Africa, leave alone the digital illiteracy of students. Asongu and Odhiambo (2019) study show that, many students who graduate these levels have unacceptable level of study skills. The review under this study has also shown that, there is a gap in terms of ICT investment between primary, secondary and university education settings in Sub Sahara Africa. Universities are relatively equipped with ICT resources and infrastructure of course far than the primary and secondary schools (eg. Barakabitze et al., 2019).

In Tanzania for instance, the study by Kihoza (2017) confirms serious constraints to students' acquisition of ICT experience in Tanzanian public secondary schools due to schools' lack of e-readiness in terms of infrastructure and teachers' technology-connected pedagogies. Malekani's (2018) study in selected schools in Morogoro Tanzania similarly observed poor status, with illiterate teachers, schools unconnected

to reliable power, lack of computers in schools and academic arrangements which do not embed ICT uses. The implication in this study connects with Asongu and Odhiambo (2019) that, governments and support stakeholders have a critical role to ensure that, ICT use is promoted and implemented in pre-university education to support students' lifelong learning in ICT environment (Barakabitze et al., 2019).

Generally based on the data, findings and discussion under this section, students' prior ICT background is diverse and majority of students used computers for the first time at the university. Such prior background guarantees uncomfortable transition of students to university's ICT environment for learning and makes it desirable for actors in the education system to coordinate the ICT environment for learning across the structure of formal school system.

### 4.3 Summary of Chapter Four

The chapter captured the demographic attributes of respondents, whose position/roles determine the ICT environment and its implication on how students learn with ICTs. The chapter further provides the data, findings and discussion for each of four (4) specific study objectives. The next chapter (chapter five) presents the summary of findings, conclusions and recommendations which reflect the objectives of the study, answers to critical questions and some pending issues different actors around students' use of ICT for learning in universities should address.

# CHAPTER FIVE

# SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Introduction

This chapter encompasses a summary of findings, conclusions and recommendations based of critical aspects of findings around the influence of ICT environment on students' digital literacy skills among students in Tanzanian Universities. The thematic flow of contents for each of the sections is framed with regards to the following research questions:

i. What are the trends of digital literacy skills for learning among students at selected universities in Tanzania?

ii. What influence do the teaching and learning activities have on development of digital literacy skills for learning among students' at selected universities in Tanzania?

iii. How adequate is the basic ICT infrastructure for the development of digital literacy skills for learning among students at selected universities in Tanzania?

iv. How does the prior ICT background influence the development of digital literacy skills for learning among students at selected universities in Tanzania?

## 5.2.0 Summary

### 5.2.1 Trend of students' digital literacy skills for learning at SUA & UDSM

Under this objective, the study sought to address a question "*What are the trends of digital literacy skills for learning among students at selected universities in Tanzania?"* The focus was based on the assumption that, a student with higher level

of digital literacy skills is at the centre of learning experience and more informed of the learning tasks in ICT environment.

The findings on students' level of basic computer operation skills have shown that, more than a half of the respondents from each university ranked their skills above intermediate, that is, between advanced and expert levels. This indicates that, majority have some confidence with their capability to operate basics of computer and therefore may not struggle much to use the computer for doing learning tasks. They can easily learn further comprehensive uses of the computers for learning. The cross tabulation results have indicated some variations based on programmes, which suggest some initiatives to support students' use of computers in certain programmes than others. Interestingly, the gender variation within and between universities is not bold, which indicate a growing parity between male and female students. It also came as surprise where a progression of year of study does not determine any significant variation in the basic skills to operate computers.

The students' rating of their skills to operate the basic features of Learning Management System particular to each university depicted that, more than half of the respondents from each university comprise learners, novice and intermediate levels. This means, such student respondents do not have confidence to operate the basic features of LMS such as user account, log in, privacy setting and other basic features needed to access learning tasks through the LMS. Therefore, such students are likely to be encountering serious challenges in their attempt to use the system for learning. The qualitative findings indicated that, majority of students in each of the selected universities do not have adequate exposure to training and use of the system. The cross tabulation results confirmed some association between the skills' category and

programme of study such that, students in about 50% of programmes for both UDSM and SUA had some exposure to LMS uses. While the findings do not indicate consistently the development of skills to operate LMS with change in year of study, majority of female students for both rated their skills higher compared to males, which further indicate a growing female-technology confidence.

The study further explored five key informational literacy skills in the selected universities: These are to identify and search for information; create and use contents ethically, evaluate, communicate and collaborate online, and protect personal data and privacy. The skills to identify and search information relates to one's ability to identify information/material needs, use up-to-date search strategies for the digital materials and tailor them rightly to learning tasks. The study found that, majorities of student for SUA and UDSM respectively, perceived their skills level between basic and intermediate. Such students struggle to use search strategies for materials from digital sources and tailor them to current learning tasks. Some students would even rate themselves skilled enough because of ignorance, but actually had limited skills. The cross tabulation results indicated that, the pattern of skills to search and filter information is patterned in favor of some programmes for both universities over others. The pattern is also in favor of females (for SUA) but with gender indifference at UDSM.

An impression based on cumulative data for the two universities has shown that, 50% of respondents at UDSM and 51.7% at SUA perceive their skills level to evaluate digital information between basic and intermediate. Qualitative findings indicated that, majority of students struggle to make choice of credible materials and contents for their learning because their attempt to evaluate the relevance and credibility of

materials is limited to what the search results offer. The cross tabulation results for SUA cites students in over 50% of programmes rated their skills above average against students in over 60% of programmes at UDSM who rated it below mastery. For both cases, the study found a marginal difference between the students of different years of study, which, however, does not suffice to indicate development of digital literacy as one advances to a higher class. Female respondents discerned slightly over males in terms of the skills to evaluate digital information (for both universities), as such showing a gender match.

The study confirmed email, dropbox, Googledrive and Moodle LMS as common platforms for interaction, collaboration, and sharing data and information related to teaching and learning in the two universities. Dropbox and Googledrive are unpopular among students but not for instructors. Students' understanding and use of emails and Moodle LMS at UDSM and SUA are instructor-motivated, and that their mastery of the platforms depends on instructors' commitment its use. While students claimed to be skilled enough to use email often, instructors are skeptic that serious flaws characterize the emails students write. Some issues include poor format, delayed feedback, failure to remember their email credentials. About 60% and over 70% of programmes (for SUA and UDSM respectively) have majority of students who rated their skills to communicate and collaborate online above average. The skills match among students of different years of study in university cases indicates a similar tendency of communicating and collaborating online irrespective of students' years of study. Besides, more female students were likely to be better in online communication and collaboration over males.

With a slight margin between the selected universities, the descriptive findings show that, more than a half of student respondents for every university (50.5% and 54% for SUA and UDSM) lack skills to create and use digital contents which inhibit their ability to edit, format and integrate contents. The reviewed assignments in both universities highlighted some persistent flaws such as poor formatting, copy-paste of information, inappropriate references and citations and typographical mistakes. These altogether are likely to compromise the transfer of learning and originality of created contents. Up to 50% of students for every cohort (in both universities) have limited skills to create and use digital contents. Irrespective of the programme of study that, majority of students have a relatively weaker orientation to creating and using digital information and contents. Gender-wise, more males (at SUA) and females (at UDSM) have limited skills to create and use digital contents, indicating a gender marginal difference.

Majority of students in the selected universities have some understanding about personal data/information but are unaware of the risks associated with failure to protect such information. They are also not confident with the mechanisms they use to ensure security of their data. They however protect information which are neither academic nor family but are about their malpractices. Such students would lock files with pornographic or simply unacceptable pictures/photos and videos from leaking to friends, teachers or family members either through the ICT devices or social media. Comparatively, up to 62.6% and 52% of student respondents (for SUA and UDSM) are not/or less confident with their skills' to protect personal data and privacy in the ICT environment and therefore their data are in danger of being inappropriately used. The findings confirmed a programme divide as the majority of students with higher level skills are skewed to certain programmes. The gender-wise impression indicated

a consistent female lead for both universities. The skills were further skewed in favor of newer cohorts of students, which imply the likelihood that, they are more technologically proactive.

**Pattern of ICT use for learning at SUA & UDSM**

Similar majorities of instructors in the two universities acknowledged that they optionally employed some forms of ICT supported teaching activities every time and almost every time. Minorities (below 10%) of the instructors from each university never or almost never employed any form of ICT supported teaching activities. Instructors who employed some ICTs for teaching also needed their students to use the technology for learning. The popular ICT use learning activities in the selected universities was reflected in communication via emails; examinations, tests and assignments via Moodle LMS, online (open) lectures, discussion via Moodle LMSs and Social Networks, typing assignments/papers, electronic text materials and design and use of PPT presentations.

Some factors put UDSM more open to technology penetration over SUA (such as location in the larger city, age, ICT investments). However, students in both universities are regular users of similar ICT supported activities. Activities which are equally common include searching for textual and video materials on line, typing assignments and papers, writing emails and collaborating in social networks. The common irregular ICT uses include collaboration via LMSs, online tests/assignments/tests and the use of PPTs. An impression based on comparative analysis shows that, students' use of ICTs for learning in the two universities is unsystematic and sporadic. Some ICT infrastructures are underutilized (eg. LMSs, Social networks, Computer labs, e-resources and research tools) and; students lack the

right skills to mount effective and efficient use the ICTs. The students encountered similar difficulties to operate computer and LMSs, access the right materials, evaluate information, create and use digital contents ethically, communicate and collaborate and protect personal data and privacy. Besides, the instructors' perspective further confirms students' participation in ICT supported learning activities as between average and good. They also noted persistent weaknesses on how students use ICTs, which confirm the argument that students in the two universities are missing key skills to support learning in ICT environment. The findings provide a picture for a relatively similar pattern of students' digital literacy skills, nature of ICT use and the challenges in the course of learning with ICTs in the selected universities.

### 5.2.2 Teaching and Learning Activities and Students' DLSs at SUA & UDSM

Under this objective, the study aimed to answer a question *"What influence do the teaching and learning activities have on development of digital literacy skills for learning among students' at selected universities in Tanzania?".* The study sought to confirm the nature of teaching and learning activities and its implication on the acquisition of digital literacy skills for learning among students in the selected universities. An attempt was made to ascertain whether or not the subject contents, instructor activities, learners' activities, students and instructors' preparedness and other teaching and learning arrangements are tailored to support students' acquisition of digital literacy skills. The study found that, instructors have a choice on whether or not to use ICTs for teaching. Even when they choose to use technologies, they determine the frequency and nature of teaching the technology should support. This has both, short and long run implication as it is likely to inconvenient students' pace of acquiring the desired digital literacy skills for participating in the opportunities

offered by the technologies. The aforesaid optionality is partly due to lack of strong policy provision to motivate instructors to embed the technologies and instructors' perception about adequacy of infrastructure and value to sustain ICT supported teaching operations.

The university-specific findings indicated coincidently that, out of ten (10) support forms, both UDSM and SUA registered two (2) popular pedagogical support forms: Instructors tendency to encourage students' use of opportunities brought by ICTs for learning activities and; guidance to students on how to avoid plagiarism. The unpopular pedagogical support forms are those practiced by minority of respondents (instructors). In both universities, they include; identification of learning activities to be done by face-to-face and those for on-line mode; course syllabi whose learning activities and outcomes reflect the mastery of digital literacy skills and; tests and examinations which reflect digital literacy skills. Other unpopular support include guidance to manage digital distraction; strategies to address online footprint (online identity) and being respectful with online interaction and in sharing meaningful information; and guidance to installation/repair/maintenance of ICTs. Given the observation, the observation that majority of the forms of support (based on checklist) are unpopular, this implies some risks such that, students are unlikely to develop a consistent capability *to learn* with the ICTs. This necessitates some advocacy measures to mainstream these forms of support so that they are made part and parcel of regular classroom instruction.

Instructors' own reflection about their preparedness to support students' acquisition and use of digital literacy skills in planning, designing, implementing and assessing teaching and learning activities is generally inadequate in both universities. In fact,

the concept of *digital literacy* in the discourse of students' learning seemed to be uncommon at the selected universities. For majority of instructors, their preparedness is skewed to the use ICTs, including the LMSs for their teacher roles. Instructors' feeling represent the universities' expectations that, students should be able to learn authentically with the ICTs. As such, instructors do not conceive it as their responsibility to support students' ability to learn with ICTs. Moodle coordinators also expected students to automatically be able to use the ICTs. Although some subjects (related to Basic Computer applications) are expected to train students on the use of computer for learning (among other aspects), such subjects seem to be techno-centric and examination-oriented. Therefore, they may not adequately address students' day-to-day desired learning capabilities. The role contradiction in both universities implies that, students' digital literacy skills are generally overlooked by the actors including curriculum reviewers, quality assurance bureaus and instructors.

### 5.2.3 Adequacy of ICT infrastructure to support students' DLSs at SUA and UDSM

The focus under this objective was to address a question "*How adequate is the basic ICT infrastructure for the development of digital literacy skills for learning among students at selected universities in Tanzania?"* The assumption behind this objective was that, the possibility to maximize the returns of technology use is highest when every learner has equal and consistent access to adequate technology devices required for learning. Besides the standards based on theoretical benchmarks, the study interrogated the adequacy of infrastructure on the basis of users' experience/perception and physical verification. As such, the findings in this study represent the perspectives from actors in the use and management of ICT infrastructure. The study found some contradicting perspectives about the adequacy of various forms of ICT infrastructure and facilities from both universities. In the first

place, the findings confirmed that, majority of students rated the adequacy of up to 80% of ICTs between very poor and average, with a negligible variation of findings between SUA and UDSM. Such majorities of the students do not have confidence that the available infrastructure/facilities are adequate to navigate the desired practices in context. The findings also provide an impression that, the selected universities offer relatively similar ICT environment for learning.

On the other hand, the study found certain factors which override a clear conclusion about actual state of art for adequacy of ICT infrastructure in both UDSM and SUA. These include motivation to use the ICTs, management of the available ICTs, policy drives, mentorship and skills to use the ICTs, and the awareness over the availability of the ICTs. The impression from the findings suggests that, both students and instructors exaggerate the state of adequacy for available ICT infrastructure and facilities. For instance, students who claimed for inadequate internet had a comprehensive use of social media in non-academic activities. Similarly, those who claimed as unable to possess computers had never visited the university computer laboratories. Furthermore, despite the universities' initiatives to deploy the LMS platforms and the associated systems at a high cost, the use of such structures remains optional for both instructors and students. The study found it illogical to claim for inadequacy of infrastructure/facilities which are not in a comprehensive use. As such, both SUA and UDSM are equally challenged to engineer a change of mindset for students and instructors to appreciate the infrastructure in place, cultivate relevant skills to use the available technologies and institute appropriate management system for the infrastructure in place.

### 5.2.4 Students' prior ICT background and Digital Literacy Skills at SUA & UDSM

The current study aimed to answer a question *"How does the prior ICT background influence the digital literacy skills for learning among students at selected universities in Tanzania?"* The aim was to establish ways in which prior ICT background knowledge influences the development of digital literacy skills for learning among students in selected Universities in Tanzania. This is based on the assumption that, a coordinated technology experience/background is likely to promote authentic and consistent use of the technology for learning in universities. Based on the Education and Training Policy (among other policies) of the Tanzania's MoEST, teaching and use of ICTs in primary and secondary school levels are expected to prepare students to participate efficiently in universities where ICT uses are already comprehensive. The entry schemes for students in the selected universities draw from advanced certificate secondary education, Diplomas and other equivalent qualifications. These are backgrounds in which institutions are yet to guarantee access to and comprehensive use of technology for learning. Students have to make personal arrangements outside formal school system to acquire the digital literacy skills for learning in universities. Such background suggests a differentiated level of digital literacy skills for students enrolled to universities, and that universities are burdened to re-orient students to adapt to ICT supported learning practices.

The study found that, majorities of students in both UDSM and SUA are aware of the importance of possessing ICT devices (eg. computer) for learning. Newer student cohorts increasingly possess ICT devices which are capable of mounting more comprehensive learning activities (eg. laptop), over other devices (like smartphones). The study observed an increased possession of ICT devices yearly and a growing community-student model to support Digital Literacy Skills through parents,

guardians or other sponsors who bought the ICT devices like computers for use in university. More than half of the student respondents for each university had taken some ICT trainings (from multiple platforms) prior to university admission. The identified platforms include prior secondary school experience, training by family members and peers and certification courses in computer from some colleges/training centres. The prior experience for majority of students in selected universities had not built confidence to learn with ICTs because of the impractical nature of the training the students went through. This implies that, due to diversity of prior ICT experience that students exhibit towards their entry to university, they have fragmented levels of digital literacy skills. Unless this background is appropriately integrated to university learning practices, students will encounter serious challenges to learn with the technology and that is likely to frustrate their learning practices throughout.

## 5.3 Conclusions

**On the trend of students' Digital Literacy Skills for learning at UDSM and SUA**

The study explored the level of students' digital literacy skills for learning by drawing from two perspectives: students' own perception of their skills level and; interrogation of students' actual ICT use in the learning. Students in selected universities have questionable level of both operational and informational digital literacy skills and therefore are unlikely to learn effectively in ICT environment. The study concludes that, government and universities have challenges to address. They must prioritise the support for students' digital literacy skills if the use of ICTs in learning should address the strands of participation (access), quality and efficiency in students' learning. Besides, as the use of ICT for learning among students in the selected universities continues to be optional, inconsistent and unguided, such practices do not suffice to make students develop the appropriate skills to learn authentically with

ICTs. Some connected risks suggest that, students can graduate incompetent in subject contents and skills for life-long learning in the current digital environment

**On the Teaching and Learning Support for students' Digital Literacy Skills**

The study sought to confirm whether the process of teaching and learning is structured to support students' acquisition of digital literacy skills for learning. Congruent to the Situated Learning Theory, the current study conceived students' acquisition of digital literacy skills in the context of concrete pedagogical instructions. Some policy loopholes at both UDSM and SUA provide optionality on whether or not to use ICTs and the nature of teaching and learning activities the technology should support. Students' digital literacy skills are not part and parcels of pedagogical operations in class. Unfortunately, instructors' preparedness to support students' acquisition and use of digital literacy skills is generally inadequate. The study highlights that, students' digital literacy skills are generally overlooked by the operational structures including curriculum reviewers, quality assurance bureaus and instructors. While some subjects (related to Basic Computer applications) were expected to train students on the use of computer for learning, such subjects seem to be examination-oriented and may not adequately address students' day-to-day DLSs desired for learning. In both, short and long run, this is likely to frustrate students' pace of using ICTs and participation in opportunities brought by the technologies.

**On the Adequacy of ICT infrastructure and Acquisition of Digital Literacy Skills**

The study found that, although the selected universities are challenged to expand their infrastructure base to support learning, the available ICT infrastructure and facilities have not been adequately exploited. The inadequacy of ICT infrastructure/facilities is exaggerated, because after all, the available ICT infrastructure and facilities are yet to

realize its expected use. The findings lead to a conclusion that, the core challenge SUA and UDSM face is change of mindset for instructors and students, making them to appreciate and reform their teaching/learning practices. Certainly, as the ICT infrastructure investment in the country and at UDSM and SUA were sought to transform students' learning, universities still have a long way to translate the invested ICTs into competitive graduates and life-long learners.

**On Students' Prior ICT Background and digital literacy skills for learning**

The teaching and use of ICTs in primary and secondary school levels are expected to prepare students to learn efficiently in universities which embrace the use of ICTs for teaching and learning. The gap in terms of ICT investment between primary, secondary and university education settings suggests that, universities are relatively more equipped with ICT resources and infrastructure than the lower school levels. As such, irrespective of the students' entry schemes to universities, their readiness to learn with ICTs is generally imperfect. Universities which use ICTs for learning must demonstrate sustainable arrangements to support students who transit to universities without or with imperfect prior ICT experience and mentor them to adapt appropriately to the best ICT supported learning practices. The study appreciates a growing community awareness and consciousness to support students' digital literacy skills. For example, parents/guardians purchase ICT devises for the students, which presents an opportunity for universities to capitalise the mainstream for sustainable ICT use at the university. Furthermore, some students were admitted to universities without ICT use experience and any digital literacy skills to comprehend ICT supported instruction. As such, if these experiences are not appropriately integrated, students who are otherwise competent are likely to perform poorly in academics due to lack of study skills in the context of ICT learning environment.

## 5.4 Recommendations

### 5.4.1 Policy Recommendations

**Recommendations to the Central Government**

Firstly, in the context of Tanzanian government and Universities, "*digital literacy skills"* is a new stand-point in research, leave alone its practices. The education system at different levels has not embraced adequately the practices to support students' acquisition of the skills. This is a concern for the government and its agencies (such as the Commission for Universities) and universities. The study recommends that, digital literacy skills should be an integral practical and policy component of the whole education system.

Secondly, the current study has noted that, the level of digital literacy skills among students irrespective of their gender, years of study and programmes of study is low. Students' ability to participate in ICT supported learning tasks is imperfect, which implies that, they are struggling to learn with ICTs. This is a decisive point, whose debates must permeate across the school system. Recommendation is made for the government to skew their efforts to focus on digital literacy skills, just like numeracy, oral skills, reading and writing.

Thirdly, majority of students in primary and secondary education levels has limited exposure to ICTs and ICT supported instructions. This makes them encounter severe challenges to adapt the use of ICTs in universities. The study recommends for the Ministry of Education to mobilize resources and build ICT capacity of schools and regional libraries to provide orientation and mentorship to students and school graduates prior university admission.

**Recommendation to the selected Universities**

Firstly, instructors are central to students' use of ICTs and acquisition of digital literacy skills for learning. The study found that, the concept of Digital literacy Skills for learning is a new story to instructors, and they do not think it is their responsibility to support students' acquisition and use of the skills. The study also noted that, while the subjects aimed to develop students' digital literacy skills are examination-centered, instructors are not prepared to support such students' skills. The study recommends for universities to support instructors to embrace the skills and make the skills part and parcel of trainings geared promoting ICT use capabilities.

Secondly, although the selected universities are challenged to expand their ICT infrastructure base to accommodate the admitted students, some of whom cannot afford personal ICTs, universities need ICT policy which will emphasize on the use of available ICTs. So far, the selected universities have made strides in ICT infrastructure investment. However, the available infrastructures have not realized the expected potentials. Universities have to strengthen their advocacy to change the mindset, so that, the available ICTs are used to enhance students' learning.

**Non-government ICT support actors**

The initiatives to support deployment of ICT have for some times been skewed to procurement of computers, servers and other hardware and software facilities. Consequently, the development of appropriate skills for students and instructors has not received the due attention. Some evidence justifies the availability of ICT infrastructure which can support a substantial amount of use for teaching and learning. Therefore, it is recommended for the donors and other support actors to ensure some focus to key competencies to use the available ICTs.

### 5.4.2 Recommendations for Further Studies

Digital literacy skills' dimension of ICT use is a new perspective of looking at the trend of ICT deployment. In fact, it is an angle which justifies the extent to which the attempts to use ICTs are making sense. The current study therefore sets a basis for further studies in the following areas:

Firstly, the current study was confined to two universities in the country; although the two universities are renowned and are actually the historically giant universities, it may be important to investigate the extent to which other universities in the country are implementing the UNESCO'S Education 2030 aspect of digital literacy skills.

Secondly, the current study explored the level of students' digital literacy skills by triangulating students' own perspectives, instructors and other technical team members. In an attempt to do so, the study became a huge one to elicit the most detailed information. This provides a room for studies which may only focus on students' level of individual elements/areas of digital literacy skills.

Thirdly, the current study was cross-sectional in nature, carried out at a single point in time. It was important to carry it within such a time under the study leave. A longitudinal study for a span of more time can indicate some changes which might have been difficult to capture at a time.

Fourthly, the current study focused on how the logistical aspects of infrastructure, pedagogies and prior ICT experience may have had impact on students' digital literacy skills for learning. A different study may be carried out to critically explore mechanisms for policy support on students' digital literacy skills for students and instructors.

## 5.5 Contribution of the Study

The current study is timely and its knowledge contribution cannot be overemphasized. The presence of computers, LMSs and internet in the investigated universities are likely to have made no value to students' authentic learning. Although the literature has confirmed the presence of some ICTs for students' learning in the universities, the current study has noted a limited level of digital literacy skills for learning for majority of students, irrespective of gender, year and programme of study. The study found in many cases that, the skills gap between male and female students is closing. The study also revealed some surprising results where the digital literacy skills level of different classes/years of study is insignificant. Based on the findings, one sees students who are at risk of graduating without substantial level of digital literacy skills, which limits their lifelong learning and employability in 21$^{st}$ C. The context specific impression implies that, the different investments to mount the use of ICTs may not realise its value unless student are prepared to authentically learn with the ICTs. The current findings that instructors are not prepared to support students' ability to learn with ICTs necessitate institutional efforts towards this direction. This study is therefore a justification of the need to re-design the ICT environment and instructions which enables students *to learn* how *to learn* with ICTs.

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# APPENDICES

## Appendix A: Instruments

### A1: Students' questionnaire

I am a PhD student (Comparative Education) at Kenyatta University in Nairobi-Kenya. I kindly request your time to provide input to my study which interrogates the "ICT environment and students' Digital Literacy Skills for learning in selected Tanzanian Universities". I assure you that, the information you provide for this study will only be for academic purpose as per the ethical standards emphasized by Kenyatta University. This questionnaire has two (2) major parts: Part A seeks your demographic information in relation to the study. Part B consists of questions which seek your opinions on study's key questions. It will take you about Seven (7) to Ten (10) minutes to complete this questionnaire.

**Part A: Respondents' Demographic information**

**Sex:** 1. Female [ ] 2. Male [ ]

**Year of study:** [1st, 2nd, 3rd, 4th]

**University:** _____

**Programme of study:** _____

**Age (Years):** 16-20 [ ] 21-25 [ ] 26-30 [ ] 31-35 [ ] 36-40 [ ] Above 40 [ ]

## Part B: Objectives' Specific information

1. **Trend of students' Digital literacy Skills for learning**

   a) Rate yourself on the following measures of Digital Literacy skills for learning at the scale of: 0=Basic [learner]; 1=Novice [limited knowledge] 2= Intermediate [limited practical application] 3= Advanced level Mastery] 4=Expert [Professional]

| # | Aspects of Digital literacy skills (ICT competencies) | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| i | Basic knowledge of hardware such as turning on/off, charging, locking computer or similar devices and ability to identify and use the functions and features of the computer/device and its related hardware for learning activities | | | | | |
| ii | Basic knowledge and skills for using the Learning Management System (LMS) operations such as user account, how to log in, how to do privacy setting and understanding of information to needed to operate the LMS features for learning | | | | | |
| iii | Ability to identify information/material needs, use up-to-date strategies to search for the materials on line and tailor them appropriately to the learning activities. | | | | | |
| iv | Ability to analyse, interpret, compare, and critically evaluate the credibility of the searched information | | | | | |
| v | Ability to use searched materials/information appropriately in the learning processes | | | | | |
| vi | Ability to organise, format, store and retrieve digital materials for use in the learning activities | | | | | |
| vii | Ability to use ICTs (eg. computers, smart phones, videoconferencing, web conferencing and webinars) to interact, share digital materials and learn in collaboration with others | | | | | |
| viii | Ability to produce simple digital contents (e.g. text, tables, images, audio files) in at least one format using ICT tools. | | | | | |
| ix | Ability to refine, modify, improve and link digital materials to the knowledge I have, in order to develop new and relevant content and knowledge | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| x | Ability to use electronic materials ethically, in order to avoid such issues like plagiarism or illegal copy and paste in academic writing. | | | | | |

**1. b) Patterns of ICT use (in learning) among students**

How frequently do you engage yourself in the following learning activities? 0=Never (0%), 1= Rarely (about 20%), 2= Sometimes (About 50%) 3= Often (about 70%) 4= Always (about 100%)

| No | ICT mediated learning activity | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| i | Type and format notes and assignments by using Computer | | | | | |
| ii | Design and make PowerPoint presentation as part of classroom learning activities | | | | | |
| iii | Online discussion by using the university Learning Management System (eg. Moodle-e-learning) | | | | | |
| iv | Online discussion of learning activities by using Social Networks/Media (eg. LinkedIn , research gate, WhatsApp) | | | | | |
| v | Searching online materials for learning tasks/assignments | | | | | |
| vi | Online lectures with university lecturers | | | | | |
| vii | Open Online lectures and tutorials (eg. From Youtube) to complement class learning activities and materials | | | | | |
| viii | Online Tests on university Learning Management System (e-learning) | | | | | |
| ix | Online University examinations by using university Learning Management System | | | | | |
| x | Email communication with lecturers and your fellow students | | | | | |

**2. Classroom support for DL skills for learning in universities**

*Based on your classroom experience, answer the following questions with regards to forms of support for Digital Literacy skills for learning at university*

a) Is there a specific subject that train on the use of ICT for learning? Yes [ ] No [ ] I am not sure [ ]

b) If the answer (above) is Yes, please name the subject(s)/course(s) _____

**c)** Based on your classroom experience, rate the availability of the following forms of support for DL skills b) Based on your classroom experience, rate the following forms of support for Digital Literacy skills for learning (where 0= Support not available [ ] 1= Support available in few subjects [ ] 2= available in majority/all subjects [ ] 3= Support available only in a specially (identified) Subject(s) [ ](*You can indicate more than one options)*

| # | **Forms of Classroom Support** | **0** | **1** | **2** | **3** |
|---|---|---|---|---|---|
| i | I am encouraged to use opportunities brought by ICTs and social networks in learning activities and collaboration | | | | |
| ii | I receive guidance to identify the type of activities to do in face-to-face and those to do on-line | | | | |
| iii | I receive guidance on how to avoid plagiarism in my academic works | | | | |
| | I get training on how to use online reference management software | | | | |
| iv | I get guidance on how to manage distraction/confusion caused by unfamiliar use of ICTs like ICT devices, electronic materials and e-learning | | | | |
| v | I receive guidance on how to manage my online identity/footprint and being respectful with online interaction and with the information I share | | | | |
| vi | I get training for critical thinking to enhance the use of materials from digital environment | | | | |
| vii | The tests and examinations provided also evaluate my skills of using computer in learning | | | | |
| viii | The course syllabus indicates the learning activities and outcomes which reflect the development of computer use skills | | | | |
| ix | Teaching activities treat both my ability to use ICTs and course competence as interdisciplinary set of skills | | | | |

**3. Adequacy of basic ICT infrastructure to support DL skills for learning**

Rate the adequacy of the following ICT infrastructure/facilities to support teaching and learning (at 1: Very poor, 2: Below Average, 3: Average, 4: Above Average, 5 = Excellent).

| # | **Basic ICT infrastructure (including facilities and services)** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| i | Computers, laptops or mobile devices for use in learning activities and digital information search | | | | | |
| ii | Data projectors to support ICT based teaching and learning activities | | | | | |
| iii | Availability of e-resource databases and subject gateways for supporting teaching and learning | | | | | |
| iv | Internet connectivity to support teaching & learning activities in campus | | | | | |
| v | Access to electronic contents to support teaching and learning activities for the off-campus students | | | | | |
| vi | Internet connectivity for off-campus students | | | | | |
| vi | Power (electricity) to operate ICTs in teaching activities | | | | | |
| vii | Technical support services, such as installation and maintenance of ICTs for teaching/learning | | | | | |
| viii | Consistent trainings on the useful features of the LMS | | | | | |
| ix | Policies to stimulate ICT use for teaching and learning | | | | | |
| x | Special course/training on how use ICT for learning activities | | | | | |

**4. Students' prior ICT experience and DL skills for learning at university**

a) Your entry qualification to the university: 1=Mature age entry Examinations [ ] 2: Advanced Certificate of Secondary Education [ ] 3: Equivalent qualifications [ ] 4: Ordinary Diploma [ ] 5: Others (identify) _____

b) Please rank your level of ICT skills at the first time you were admitted to the University

i. Very Poor [ ] ii Below Average [ ] iii Average [ ] iv. Above Average [ ] v. Excellent [ ]

c) Reflect your ICT experience and readiness (at the entry to university) for ICT enabled instruction at the university, where 1= Yes 2= No

| No | **The aspect of Prior experience** | **1** | **2** |
|---|---|---|---|
| i | I had my own computer/laptop/Ipad/Smartphone | | |
| ii | I was aware that computer/laptop/Ipad/smartphone is a requirement for learning at the university | | |
| iii | I had already learned how to operate the (computer/laptop/Ipad/smartphone) for learning activities | | |
| iv | I had already learned how to search for, evaluate materials online and write a good paper | | |
| v | I had already learned how to turn on/of, log in to my account, do privacy setting and do the installation of some software like antivirus for a computer | | |
| vi | It was just easy to type my first assignments by reading from the internet resources | | |
| vii | The ICT experience from my prior school has been supportive of how I use the ICTs for learning at the university | | |
| viii | I did some computer courses/training in my previous schooling, and that helped me to use ICT for learning at University | | |
| ix | The use of ICT for learning at the university was a completely new experience and therefore I had to learn each and everything to use ICT for learning activities | | |
| x | My prior ICT experience was inadequate and limited my transition to learning practices in university | | |

**Thank you for taking time to respond to this questionnaire!**

## A 2: Questionnaire for Instructors/lecturers

**PART A: Demographic information**

**Sex** 1. Male **[ ]** 2. Female **[ ]**
**Name of the University** _____
**Faculty/School** _____
**Your highest level of Education:** Bachelor Degree [ ] Master Degree [ ] PhD [ ] Others (Specify) _____
**Academic Position:** Tutorial Ass. [ ] Ass. Lecturer [ ] Lecturer [ ] Senior Lecturer [ ] Professor **[ ]**

**Age (Years):** Below 30 [ ] 30-40 [ ] 41-50 [ ] 51-60 [ ] Above 60 [ ]
**Working Experience (Years):** Below 1 [ ] 1-5 [ ] 6-10 [ ] 11-20 [ ] Above 20 [ ]

**B: Specific study information**

**1. Pattern of ICT use for teaching students (supporting students' learning)**

**a)** How often do you use ICTs for teaching students?

i. Never [ ] ii. Almost never [ ] iii. Occasionally/Sometimes [ ] iv. Almost every time [ ]Every time [

**b)** How frequently do you engage students in the following class learning activities**?** (0=Never; 1=Rarely (less than 50%); 2=Sometimes (50%); 3=Often (About 70%); 4=Always (100%)

| No | Students' ICT mediated learning activities | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| i | Type and format notes and assignments | | | | | |
| ii | Design and make PowerPoint presentation as part of classroom learning activities | | | | | |
| iii | Online discussion by using the university Learning Management System (eg. Moodle) | | | | | |
| iv | Online discussion of learning activities by using scholarly and professional Social Networks (eg. LinkedIn , research gate, WhatsApp) | | | | | |
| v | Searching for online materials to write individual and group learning tasks | | | | | |
| vi | Online lectures to complement class learning activities and materials | | | | | |
| vii | Online tutorials to complement class learning activities and materials | | | | | |
| viii | Online Tests through university Learning Management System (E-learning) | | | | | |
| ix | Online University examinations by using university Learning Management System (E-learning) | | | | | |
| x | Email communication with students | | | | | |

**c)** Based on your experience and/or perception with ICT use for teaching undergraduate students at university, how do you generally describe the quality of students' participation in the ICT supported learning activities expected of them? Very Poor [ ] Poor [ ] May be [ ] Good [ ] Very Good [ ]

**1** Classroom support for Digital Literacy skills for students' learning in universities

a) The use of ICT in teaching at the University is i. Mandatory [ ] ii. Optional [ ]
b) Based on teaching experience, indicate the pattern of the following forms of support to your students (at the scale of 0=Never 1=Rarely 2= Sometimes 3= Often 4= Always)

| # | Form of Classroom Support | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| i | I encourage them to use opportunities brought by ICTs and social networks in learning activities and collaboration | | | | | |
| ii | I identify in advance the type of activities to be done through face-to-face and others through on-line mode | | | | | |
| iii | I guide my students on how to avoid plagiarism in classwork writing | | | | | |
| iv | I guide them to manage digital distraction when using digital tools for learning | | | | | |
| v | I guide them on how to manage online identity/footprint and being respectful with online interaction and in sharing meaningful information | | | | | |
| vi | I embed tasks for critical thinking to enhance their use of information from the digital environment | | | | | |
| vii | The mastery of digital literacy skills in class are also reflected in the purpose of Tests and Examinations | | | | | |
| viii | The course syllabus indicates learning activities and outcomes which reflect the mastery of digital literacy skills | | | | | |
| ix | I structure the teaching activities to create synergy between the ICTs and subject-based learning activities with the aim of developing both as interdisciplinary set of skills | | | | | |
| x | I advise where to seek support in such aspects like installation, maintenance/repairs of their ICTs for learning. | | | | | |

**c)** Rate your general preparedness to provide students with the forms of support (above) to develop Digital Literacy skills for learning at 0: Not at all 1: Not much 3: Somewhat 4:A great deal

**2:** Adequacy of basic ICT infrastructure to support students DL skills for learning

Based on your instructor role, rate the adequacy of the following sets of ICT infrastructure/facilities to support students' learning (at the scale 0: Very poor 1: Poor (up to 20%) 2: Fair (up to 50%) 3: Adequate (up to 70%) 4: Very adequate (up to 100%).

| # | Basic ICT infrastructure (including facilities and services) | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| i | Computers, laptops or mobile devices to support digital data and information search for students | | | | | |
| ii | Data projectors to support ICT based teaching and learning activities among students | | | | | |
| iii | Availability of e-resource databases and subject gateways for supporting students' learning | | | | | |
| iv | Internet connectivity to support teaching and learning activities in campus | | | | | |
| v | Internet connectivity for off-campus students | | | | | |
| vi | Remote access to electronic contents to support teaching and learning activities for the off-campus students | | | | | |
| vii | Power (electricity) to operate ICTs in teaching and learning activities | | | | | |
| viii | Technical support services, such as installation and maintenance of ICTs for teaching/learning | | | | | |
| ix | Consistent trainings on the useful features of the LMS used at university | | | | | |
| x | Policies to stimulate ICT use for teaching and learning | | | | | |
| xi | Special course/training on electronic information literacy skills to support ICT supported learning | | | | | |

**4) Students' prior ICT experience and Digital Literacy skills for learning at university**

a) Based on your teaching experience specifically with first year students, do the students enrolled to university studies have prior ICT experience to support smooth transition to ICT supported learning at university?? 1. Yes, majority do [ ] 2. No, majority don't [ ] 3. Fifty, fifty [ ] 4. Am not sure [ ]

b) What are the persistent learning attributes/behaviors displayed by learners which define their capacity to use ICT for learning? Eg. Students can/not type and format assignment; students can/not use technologies to make presentation; students do/not observe ethics in writing etc..

## A 3: Semi-structured Interview for Moodle (LMS) Coordinators

1. How far is the university doing to implement the use of ICT in teaching and learning?

   (Is there a prescribed form of ICT use for T/L? How are the students and instructors prepared to use the ICTs to support learning?)
2. Is there a framework to implement the ICT use for teaching and learning?

- Is there a policy?
- Any Guideline/framework?
- Is technology use mandatory/optional?
- How are the instructors and students prepared? Do you consider students' prior ICT backgrounds when designing course to train students on digital literacy skills?

3. How is ICT used? What is the LMS (if available) used for? How do you manage its use? When/how are students and instructors prepared to use ICTs? What is the position of social networks in the university LMS?
4. What are the structures which justify the university readiness of students to use ICT for learning? (In terms of infrastructure, Pedagogies, Budget, Students' orientation, Competency framework, Synergy with other school levels and Policy support).

## A 4: Key Informants Interview Guide

**KII 1: Deputy Vice Chancellors for academic affairs**

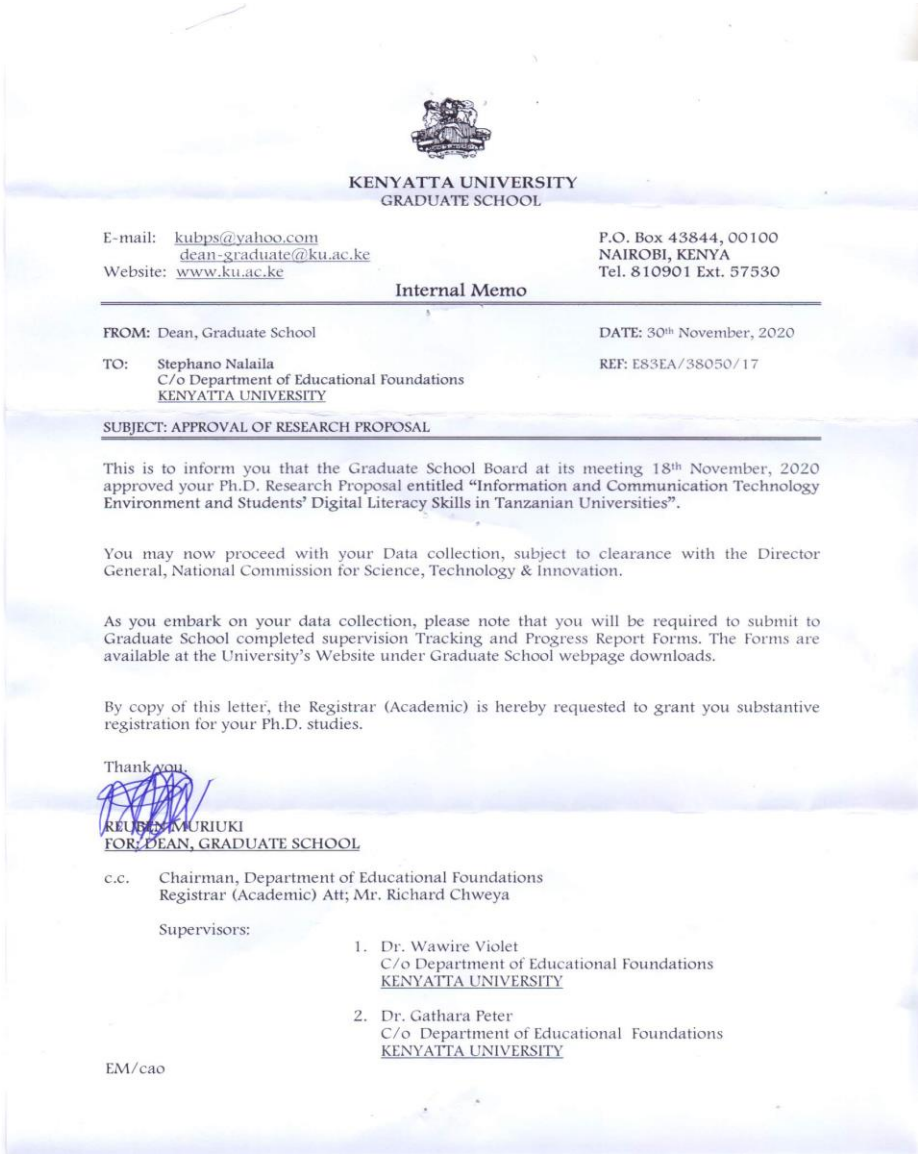
1. How far is the University doing to implement the use of ICTs for teaching and learning? (Are you aware of the ICT use practices instructors and students use? In which ways are the students' learning a focus of the technology use)
2. What is the motive for the current ICT use practices at the university? (The aim is to find out if a university is taking the ICT use as mandatory or optional, and if the same are conditions for staff regulations or any performance requirements (such as strategic plans).
3. Are there guidelines for implementing ICT use for teaching? (if yes, What are the general conditions on the implementation of the ICTs for teaching and learning?) Are there frameworks of implementing the ICT use (for example, is there a prescribed form of ICT use? Are there specific activities students must learn online? Are there specific skills you think/embrace can help students use to learn in ICT context? .
4. What are the students' related environmental factors which are considered in the implementation of ICT use? (how are the students prepared to implement ICT use?; is there adequate infrastructure?, Do students have the relevant ICT skills at the arrival to the university, do instructors take into account students' prior ICT experience implementing ICT use for T/L activities?
5. What lessons does the university take on board from the experience of University closure (due to COVID 19) regarding students' participation in ICT mediated learning? Is the use of ICT new/common or implemented as a normal practice/rescue alternative?.

## A 5: Observation Checklist

The researcher will seek to elicit evidence related to:

- Hardware, software and ICT facilities and services in universities (also seek the ratio)
- Students engagement in ICT mediated subject-related learning activities (typewritten papers, ethics in writing and records of online activities and contents)
- Students platforms for information sharing and collaboration (eg the design and use of PPT presentation
- Classroom ICT mediated T/L activities between instructors and students
- Evidence for ICT for learning Policy or guideline/framework
- T/L designs and course outlines of the subjects/courses which support students' DL skills
- Availability of e-resources at the university
- Levels of the utilization of e-resources at the university

## Appendix B Proposal Approvals



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 30th November, 2020

TO: Stephano Nalaila
C/o Department of Educational Foundations
KENYATTA UNIVERSITY

REF: E83EA/38050/17

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

This is to inform you that the Graduate School Board at its meeting 18th November, 2020 approved your Ph.D. Research Proposal entitled "Information and Communication Technology Environment and Students' Digital Literacy Skills in Tanzanian Universities".

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking and Progress Report Forms. The Forms are available at the University's Website under Graduate School webpage downloads.

By copy of this letter, the Registrar (Academic) is hereby requested to grant you substantive registration for your Ph.D. studies.

Thank you.

REUBEN MURIUKI
FOR: DEAN, GRADUATE SCHOOL

c.c. Chairman, Department of Educational Foundations
Registrar (Academic) Att; Mr. Richard Chweya

Supervisors:

1. Dr. Wawire Violet
C/o Department of Educational Foundations
KENYATTA UNIVERSITY

2. Dr. Gathara Peter
C/o Department of Educational Foundations
KENYATTA UNIVERSITY

EM/cao

## Appendix C: Research Authorization

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: E83EA/38050/17 Date: 30th November, 2020

The Director General,
National Commission for Science, Technology & Innovation,
P.O. Box 30623-00100,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR STEPHANO NALAILA-REG. NO. E83EA/38050/17

I write to introduce Nailala who is a Postgraduate Student of this University. The student is registered for a Ph.D. degree programme in the Department of Educational Foundations in the School of Education.

Nailala intends to conduct research for Ph.D. thesis entitled, "Information and Communication Technology Environment and Students' Digital Literacy Skills in Tanzanian Universities".

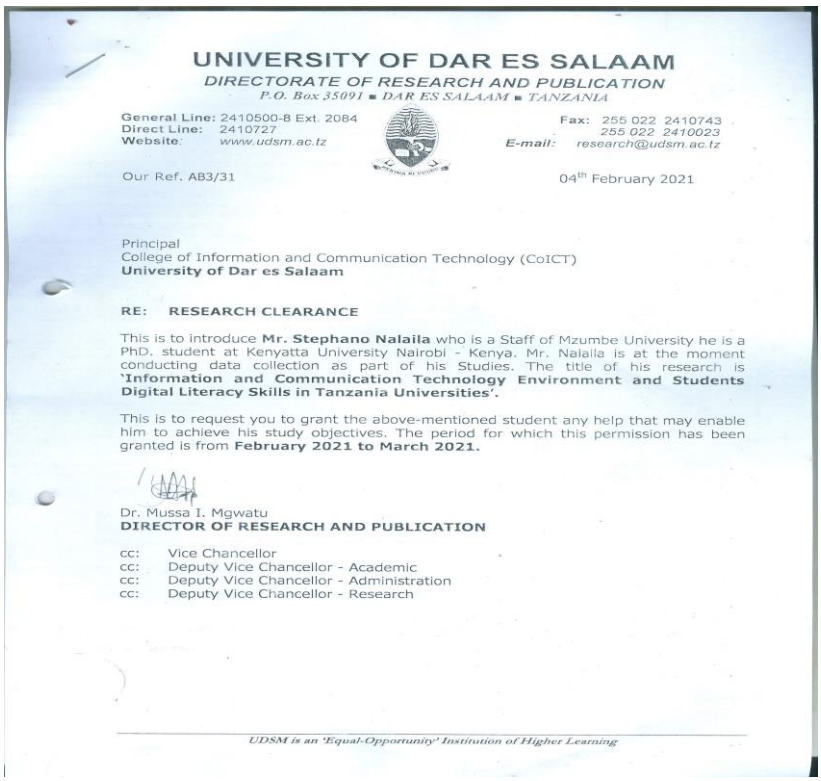
Any assistance given will be highly appreciated.

Yours faithfully,

PROF. EMSHIBA KIMANI
DEAN, GRADUATE SCHOOL

RM/cao

## Appendix D: Research Clearance



UNIVERSITY OF DAR ES SALAAM
DIRECTORATE OF RESEARCH AND PUBLICATION
P.O. Box 35091 ■ DAR ES SALAAM ■ TANZANIA

General Line: 2410500-8 Ext. 2084
Direct Line: 2410727
Website: www.udsm.ac.tz

Fax: 255 022 2410743
255 022 2410023
E-mail: research@udsm.ac.tz

Our Ref. AB3/31

04th February 2021

Principal
College of Information and Communication Technology (CoICT)
**University of Dar es Salaam**

**RE: RESEARCH CLEARANCE**

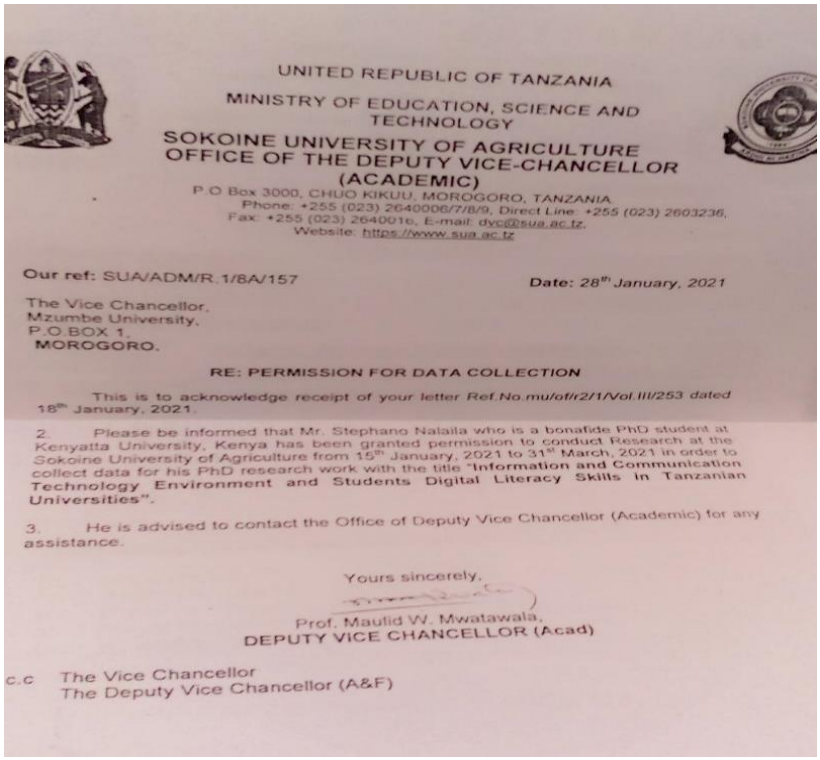
This is to introduce **Mr. Stephano Nalaila** who is a Staff of Mzumbe University he is a PhD. student at Kenyatta University Nairobi - Kenya. Mr. Nalaila is at the moment conducting data collection as part of his Studies. The title of his research is **'Information and Communication Technology Environment and Students Digital Literacy Skills in Tanzania Universities'.**

This is to request you to grant the above-mentioned student any help that may enable him to achieve his study objectives. The period for which this permission has been granted is from **February 2021 to March 2021.**

Dr. Mussa I. Mgwatu
**DIRECTOR OF RESEARCH AND PUBLICATION**

cc: Vice Chancellor
cc: Deputy Vice Chancellor - Academic
cc: Deputy Vice Chancellor - Administration
cc: Deputy Vice Chancellor - Research

*UDSM is an 'Equal-Opportunity' Institution of Higher Learning*



UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
SOKOINE UNIVERSITY OF AGRICULTURE
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Website: https://www.sua.ac.tz

**Our ref:** SUA/ADM/R.1/8A/157 **Date:** 28th January, 2021

The Vice Chancellor,
Mzumbe University,
P.O.BOX 1,
MOROGORO.

**RE: PERMISSION FOR DATA COLLECTION**

This is to acknowledge receipt of your letter Ref.No.mu/of/r2/1/Vol.III/253 dated 18th January, 2021.

2. Please be informed that Mr. Stephano Nalaila who is a bonafide PhD student at Kenyatta University, Kenya has been granted permission to conduct Research at the Sokoine University of Agriculture from 15th January, 2021 to 31st March, 2021 in order to collect data for his PhD research work with the title **"Information and Communication Technology Environment and Students Digital Literacy Skills in Tanzanian Universities".**

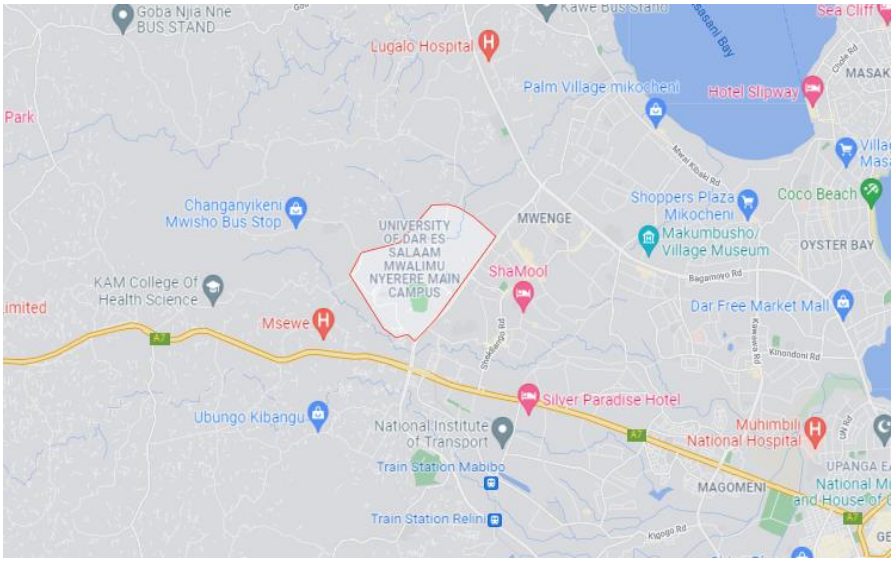
3. He is advised to contact the Office of Deputy Vice Chancellor (Academic) for any assistance.

Yours sincerely,

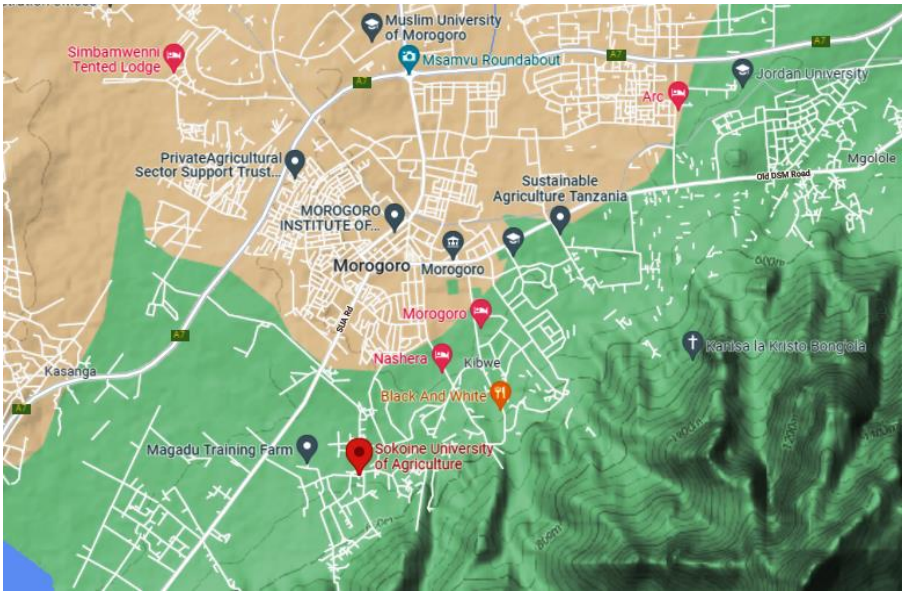
Prof. Maulid W. Mwatawala,
DEPUTY VICE CHANCELLOR (Acad)

c.c The Vice Chancellor
The Deputy Vice Chancellor (A&F)

## Appendix E: Maps of Study Sites




THE UNIVERSITY OF DAR ES SALAAM-DAR ES SALAAM, TANZANIA




SOKOINE UNIVERSITY OF AGRICULTURE-MOROGORO, TANZANIA