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# Usability and user experience of Moodle learning management system into higher learning of Tanzania

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**USABILITY AND USER EXPERIENCE OF MOODLE LEARNING  
MANAGEMENT SYSTEM INTO HIGHER LEARNING OF TANZANIA**

**Doris G. Mwendwa**

**A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of  
Master's in Information and Communication Science and Engineering of the Nelson  
Mandela African Institution of Science and Technology**

**Arusha, Tanzania**

**August, 2022**

## ABSTRACT

According to previous works, Learning Management Systems (LMSs) have been facing obsolete rendering barriers such as accessibility of the system due to network disruption and bandwidth expenses, Digital literacy, user's perception towards the use of an online LMS in taking a course, policies towards E-learning acceleration and support, Information literacy, technological barriers, lack of relevant technical training and assistance in using LMS for the instructors, LMS's lack the ability to cater for the cultural differences, navigational issues, and misrepresentation of contents and insufficient content and credible resources. This study applied a mixed methodology and data collection was carried online, with sample survey of open and closed ended questionnaires and online interviews. Sampling technic used was snowball and the case of convenience which involved 338 participants inclusive of 112 facilitators/teachers and 226 students.

Identified prominent existing barrier by users was navigational issues, and misrepresentation of contents, which associated user experience and usability issues, using an open and free learning management system Moodle, a "Jifunze kwa Moodle" prototype was created. Assessment was conducted to identify tools to be applied and improve user experience and usability in the final prototype of the "Jifunze Kwa Moodle" platform using Rapid Application Development.

Online teaching and learning tools such as H5P and BigBlueButton were integrated into the platform to entice interaction between facilitator and students. The platform was shared, and only 20 users had accomplished the tasks assigned, thus 6 facilitators and 14 students. Users assessed the platform through task-based scenarios so as to accommodate responses and improve the platform, tasks such as initiating a class using H5P and BigBlueButton were essential for the instructors and students had to attend some sessions. Conclusively this study opens up the opportunity to engage in making learning management systems user friendly, interactive and simpler using online teaching and learning tools to accommodate different users' need.

## DECLARATION

I, Doris G. Mwendwa, declare that this dissertation is my own original work and that it has neither been submitted nor being concurrently submitted for consideration of a similar degree award at any other University.

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## CERTIFICATION

The undersigned certify that they have read and found the dissertation conform to the standard and format acceptable by the Nelson Mandela African Institution of Science and Technology.

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## **DEDICATION**

This study is wholeheartedly dedicated to my parents, siblings, relatives and friends, for they have been continuously pouring a lot of encouragements that has become a pillar of reliance and inspiration to my work. Boosting my self-esteem by teaching me about putting in more effort, honesty and modest in everything pays off at the end.

And lastly but not least, to God, thank you for health life, protection, skills and power of mind.



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## LIST OF ABBREVIATIONS

BL	Blended Learning Courses
BYOD	Bring Your Own Device
CSS	Cascading Style Sheet
EJS	Easy Java Simulation
ESD	Education for Sustainable Development
H5P	HTML 5 Package
HLI	Higher Learning Institution
HTML	Hypertext Markup Language
ICT	Information Communication Technology
LMS	Learning Management System
MOOCs	Massive Open Online Courses
MOODLE	Modular Object-Oriented Dynamic Learning Environment
OSP	Open-Source Physics Repository
PHP	Hypertext Pre-processor
SQL	Structured Query Language
TEL	Technology Enhanced Learning
VRL	Virtual or/and Remote Lab
WAMP	Windows, Apache, MySQL and PHP
XML	Extensible Markup Language

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the Problem

A Learning Management System is a software application, either proprietary or open-source that assists tutors on a specific intent of reaching their pedagogical goals and deliverance of learning materials to a group of students. Ngeze (2016), described the three LMS's categories, such as proprietary systems for example Blackboard, open-source systems for example Moodle and finally in-house systems, for example Coursera and IBM Online courses. As a standard presentation of virtual learning for both facilitators and students LMS promotes social constructivism, increase of digital skills and self-efficacy (Holmes & Prieto-Rodriguez, 2018) by simplifying the accessibility of materials, via substantiated user identifications and assessment of performance remotely (Araka *et al.*, 2019; Kibuku & Ochieng, 2019). A standard learning management system should meet the following criteria but not limited to usability, scalability, high availability, interoperability, stability, security and sustenance (Marques *et al.*, 2015; Ngeze, 2016; Rasmitadila *et al.*, 2020).

According to Khairudin *et al.* (2016) Learning Management System (LMS) is an expansive term used commonly to describe systems that provide online education and learning services for students, teachers, administrators, and managers. In general, these services contain some fundamental accommodations such as limited access control to authorized people, provide different types of learning content and communication tools. Several authors Tvenge and Martinsen (2018) have elaborated that electronic learning (e-learning) has evolved from being closed off and centered on the individuals to be social and where sharing is essential. The learner's needs are at the center, not the technology itself.

According to Tvenge and Martinsen (2018), stated that learning has been retracted from formal ways of teaching and basically refrain from the traditional way of learning for example face to face teachings, physical repositories like libraries, and entice the electronic way of learning, since it simplifies the whole arena of concrete analogy of a hectic study schedule. Additionally, bearing this ICT based learning can have other contributing factors to promote its relevant usability and satisfaction. Student's perception towards technology usage, autonomous learning, modes of task value and self-efficacy without being limited to socialization, system's



quality, and multimedia instruction can influence the user experience of any ICT based learning (Horvat *et al.*, 2015).

Moodle is a free and open-source learning management system (LMS) that does not require a registration fee or yearly renewed fee and the current software version launched is Moodle 3.7.2 on 9<sup>th</sup> September 2019 (Moodle, 2019a). According to the cite (Moodle, 2019b), there are currently 105 453 registered sites of Moodle communities with more than 170 million users across, 229 countries around the world and more than 19 million online courses are being provided.

## **1.2 Statement of the Problem**

Blended learning has earned a place in the higher learning institutions of Tanzania by widening access of study contents via an ICT-based learning, offering mediated distance learning and facilitation of online tutoring for a campus-based course (Bhalalusesa, 2013; Mnyanyi, 2010; Mtebe & Raphael, 2018). In time other higher learning institutes failed to keep using learning systems due to adoption difficulties and obsolete, for instance study by Ngeze (2016), identified issue such as user interface and navigation complexities, network issues and lack of enough training as the hindering sources of LMS adoption at the University of Dodoma.

Research trends dedicated in identifying challenges of LMS, investigated that lack of Internet connectivity (30%) was the prominent challenge, though in other studies it didn't cause much impact, lack of support (25%), lack of awareness and negative attitude towards ICT (21.7%). However, lack of policies, lack of facilities, and inadequate funds were the least-ranked barriers to eLearning implementation in Tanzania (Mtebe & Raphael, 2018). Even with advancement of Bring Your Own Device (BYOD) and sufficient technical improvements some institutes have lost more users than gain, due to lack of interactive environment for users (Aldiab *et al.*, 2019; Donath *et al.*, 2020; Kamunya *et al.*, 2019; Poulouva *et al.*, 2015).

This study examines proactive barriers in Tanzania's higher learning institutions (HLIs) that affect both facilitators and students' relationship towards the adoption and application of LMSs. Using Moodle and online teaching and learning tools, a customized learning platform will be created so as to improve user experience and interactive learning for both facilitators and students.

### **1.3 Rationale of the Study**

Gamification has been a rewarding learning method in LMS, promoting user engagement and motivation given a proper application framework (Kamunya *et al.*, 2019). Implemented in Moodle, the TeachSuS IT&C platform has been able to deliver interactive content to students and stakeholders to conform the Education for Sustainable Development (ESD) (Donath *et al.*, 2020).

Studies have shown that the application of online teaching and learning tools have greatly impacted the LMS functionalities and enticed usability and user experience, by integrating repository tools, interactive modules and voice user interface both facilitators and students have been able to enjoy their experience in taking the blended learning courses (Centre, 2018; De La Torre *et al.*, 2015; Ochoa-orihuel & Marticorena-sánchez, 2020; Ouya & Mendy, 2015). This makes it more relevant to explore the possibilities of improving LMS using different online teaching and learning tools and improve existing LMS application.

### **1.4 Research Objectives**

#### **1.4.1 General Objective**

To improve usability and user experience of an online Moodle LMS, into higher learning of Tanzania.

#### **1.4.2 Specific Objectives**

The specific objectives of this study were:

- (i) To determine barriers facing LMS applicability into higher learning of Tanzania.
- (ii) To integrate methods and tools identified, that would customize and improve usability and user experience of Moodle LMS into higher learning of Tanzania.
- (iii) To validate the improvement of the LMS user interaction

### **1.5 Research Questions**

The research questions that this dissertation intended to answer were:

- (i) What are the barriers facing LMS into higher learning of Tanzania?

- (ii) What are the incorporated methods and tools used to customized and improve usability and user experience of LMS Moodle?
- (iii) Have the implemented methods and tools improved user interaction and usefulness of the LMS into higher learning in Tanzania?

### **1.6 Significance of the Study**

This study tackles the ideology of both interpreted and uninterpreted challenges of the existing LMS in HLIs of Tanzania, so as to identify the correlated reasons to why systems are rendered obsolete. It further associates the concept of interactive content creation and learning, by implementing approaches and activities within an existing system that satisfice user experience and usability to facilitator and student. Consequently, this can be a preliminary contribution to improvement of existing LMS into higher learning of Tanzania, through the use of online learning and teaching tools.

### **1.7 Delineation of the Study**

This study did not include all HLI in Tanzania except only those who were sampled through snowball and case of convenience sampling technic. It was also not possible to study other LMS due to proprietary copyrights, also teaching and learning tools involved had to be free and open source with existing literature review. Learning management system and tools reviewed in this study are those which have literature review and access credentials.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Application and Significance of LMS

The distance learning highly lobbies courses such as postgraduate, degree, and Ph.D. programs though due to low virtual implications, it depends on the type of course offered online with respect to specialization and enrollment. All online higher education tends to differ according to the type of course, program and subject on offer. Later it is highly promoted in small-sized institutions since educational institutions with many students approximately above 150,000 have a greater number of online postgraduate courses and attendance programs due to the greater comfortable circumstances of the students who attend their classes. In this regard, we have observed that the most highly pursued programs are those offered by business schools, followed by social sciences courses, humanities, and computing (Parra, 2017).

Previously distance learning courses seemed a bit tedious, formerly believed that a student might face seclusion from the instructor offering the course, lack of interaction with classmates and inexperienced teachers to carry out such courses came under criticism, however both criticisms have been downplayed simply because online courses indulge autonomous and self-efficacy since the format is based on a more independent workload output in a given time. With regard to inexperienced teachers, increasingly mastered online techniques and thus the tendency clearly needs to remain (Parra, 2017).

In order for any learning management system (LMS) to become adaptable, there are important elements any student has to observe. Such learning behaviors are related to students' self-concept, where any student recognizes their role as a student by providing a lens through which a student can interpret a learning experience. Case in point, self-efficacy which is identified as a way to summarize the beliefs an individual student has about their ability to successfully learn from a course of study. Additionally, self-efficacy likely supports goal-satisfying approach to the usage of any learning management system and students that exhibit high self-efficacy are likely to motivate and guide their own learning processes, with a self-directed approach, they are more likely to succeed in executing learning tasks such as uploading/downloading learning materials, viewing documents and contributing to discussion boards.

According to Prior *et al.* (2016), there are five supporting hypotheses to this concept of positive self-efficacy and their contribution to a high support of distance learning as per review. First hypothesis reviewed student's positive learning attitude towards a positive contribution of a self- efficacy in an online distance education, second hypothesis reviewed digital literacy contribution towards a positive self-efficacy in online distance education, third hypothesis reviewed self-efficacy contribution towards a positive student online peer engagement, fourth hypothesis reviewed self-efficacy contribution towards a positive student online learning management system interaction and the fifth hypothesis reviewed self-efficacy contribution towards a positive student online convener interaction (Prior *et al.*, 2016).

## **2.2 Identification of Existing Barriers through Related Works**

Information literacy skill, makes it possible for any person to pinpoint, evaluate, vouch and present credible information when needed (Koltay, 2011), such that the use of a LMS nurtures and harnesses such skills in order to take full advantage of Blended learning (McGuinness & Fulton, 2019). Data from previous studies describe that in any form of learning its justifiable to identify the most credible and relevant source that offer quality and quantifiable volume of such resource, this is to develop self-efficacy and protect users from encountering copyright issues, plagiarisms and the use of incorrect literature (Dalton, 2017; Green & Chewning, 2020; Mtebe & Kondoro, 2016; Mtebe & Raisamo, 2014; Prior *et al.*, 2016; Terzioğlu & Kurt, 2019).

Relevant literature has investigated that sufficient content in a learning management system with credibility has a vital role in lessening learner's anxiety, isolation and cognitive overload when taking an online course (Safford & Stinton, 2016). Meanwhile most instructors prefer recycling online content without checking the source's credibility, standard nor impact level causing underutilized LMSs', boredom, un-interactive system and usage of incomprehensive materials which satisfice learner's needs in a stated duration (Al-Azawei *et al.*, 2016; Dalton, 2017; Green & Chewning, 2020; Moscinska & Rutkowski, 2011; Mtebe & Raisamo, 2014; Nincarean *et al.*, 2013).

Digital literacy, is a requisite trait and ability of becoming more flexible to learning, adopting and manipulating available computing infrastructures and resources without subsuming innovative presentation (Koltay, 2011; McGuinness & Fulton, 2019). Prominently instructors and students become victims of an obsolete LMS because of lack of digital literacy, therefore

getting subjected to high cost for application and maintenance, such as demand for technical staffs and E-Learning training (Al-Azawei *et al.*, 2016; Green & Chewning, 2020; Moscinska & Rutkowski, 2011; Mtebe & Raisamo, 2014; Radif & Mclaughln, 2015).

User's perception towards the use of an online LMS in taking a course can harbor either positive or negative attitude, considering the rate of ease of use, practicality rate, how it promotes self-efficacy and the level of user-friendliness that could prompt user acceptance or user dissatisfaction of the LMS (Al-Azawei *et al.*, 2016; Dalton, 2017; Prior *et al.*, 2016). Palmer (2020), recognized that the drive to students' positive view is to entice a constructive usage of the particular LMS, by creating a conducive setting for communication with instructors, attaining enough technical skills on how to properly use LMS features such as announcement and assignment which will increase instructors' and students' comfortability in accessing the system anytime, contradictory can cause a negative attitude towards a provided LMS which confuses instructors and students whilst diminishing system usage and relevance in a given duration (Dalton, 2017).

Learning management systems lack the ability to cater for the cultural differences, due to implicit international standards, this has caused most of the LMS to be represented in English language whilst LMS with adaptive features such as additional language plugins while considering the end user's language could led to the conservation of indigenous language and would have added value to the learners and improve social constructivism (Green & Chewning, 2020). A LMS without an equal standard of inclusion will be considered as an obsolete, because it fails to accommodate a variety language based sample group and social constructivism, which is the key element of an E-learning (Moon & Villet, 2017).

A considerable amount of literature has been published on technological barriers towards E-learning systems, which include lack of hardware infrastructures such as computers and software facilitators such as the appropriate LMS to implement for a particular community and compatibility issues bringing about a high depletion level of system implementation in universities and usage to both instructors and students (Bodsworth & Goodyear, 2017; Joseph & Thomas, 2020; Mostafa *et al.*, 2019; Mtebe & Kondoro, 2016; Terzioğlu & Kurt, 2019).

It has been established from a variety of studies (Al-Azawei *et al.*, 2016; Bhalalusesa, 2013; Bodsworth & Goodyear, 2017; Green & Chewning, 2020; Joseph & Thomas, 2020; Moon & Villet, 2017; Mostafa *et al.*, 2019; Mtebe & Kondoro, 2016; Mtebe & Raisamo, 2014;

Terzioğlu & Kurt, 2019), that lack of relevant technical training and assistance in using LMS for the instructors, can led to undesirable attitude towards the use of e-learning (Al-Azawei *et al.*, 2016; Radif & Mclaughln, 2015). There are few implemented Open Education Resources (OER) initiatives in the Sub-Saharan, that provide online technical assistance and training to the instructors so as to increase confidence in e-learning use, such as TESSA (Teachers Education in Sub-Saharan Africa) and OER Africa initiatives (Moon & Villet, 2017). Thus there is still a need of similar initiatives that assist technical training scrutiny's, increase the implementation levels of LMS and offer knowledge on how to exploit them successfully (Al-Azawei *et al.*, 2016; Bhalalusesa, 2013; Bodsworth & Goodyear, 2017; Joseph & Thomas, 2020; Moon & Villet, 2017; Mostafa *et al.*, 2019; Mtebe & Kondoro, 2016; Terzioğlu & Kurt, 2019).

The lack of accessibility of the system due to network disruption and bandwidth expenses has affected both facilitators and students at a high peak to dissipate their performance, it encompasses of cost of bandwidth, maintenance of technical infrastructure and lack of funding for proper wireless infrastructures highlighted by various literature review (Shayo *et al.*, 2017; Lashayo & Olahraga, 2017; Mostafa *et al.*, 2019; Mtebe & Kondoro, 2016; Safford & Stinton, 2016; Terzioğlu & Kurt, 2019). Though contradictions show that in some HLI's slow or unreliable network issues were not the major concern that affected the use of LMS (Shayo *et al.*, 2017) but considerable acknowledgement of existence of such a barrier can easily be dissolved by strategic design of networks that supports fast data transaction.

Several systematic reviews on policies towards E-learning acceleration and support has been undertaken to promote Open Education Resources (OER) but it still has to be implemented world-wide (Bervell & Umar, 2017a; Terzioğlu & Kurt, 2019). There is still a need to create policies that support the improvement of teacher's digital literacy, OER usage and experience, and the implementation of LMS initiatives which will help improve LMS's usability, communication between students and teacher through their own comfortable choice of language and later on supplement for other modes of pedagogical such as flipped classroom (Shayo *et al.*, 2017; Lashayo & Olahraga, 2017; Moon & Villet, 2017; Mtebe & Kondoro, 2016).

It has been established from a variety of studies that navigational issues, tend to create a wave of complexity and misrepresentation of contents in the particular LMS (Kokoç & Altun, 2019). Issues like system navigational complexity are caused by teachers not being a part of the designing team, lack of enough training of the system and a negative perception towards E-learning, causing users not able to associate learning with the provided LMS, whilst a simpler system tutorial can dissolve such an issue (Joseph & Thomas, 2020; Palmer, 2020; Safford & Stinton, 2016)

Conclusively, review highlights that even after technological revolutionary still higher learning education demands a rather intuitive understanding of interactive learning, and thus blended education requires more assessment as to why adoption is still difficult even after application. Barriers identified by literature review have been highlighted throughout different studies (Mtebe & Raphael, 2018) and this study has summarized them in the following ascending order as per review Information literacy, Credible, contents, Digital literacy, Perception, Language, Compatibility, Technical training, Bandwidth, Policies and Navigation. Therefore in order to have an interactive learning environment, assistive tools and methods have to be incorporated.



## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Identification of Existing Barriers in HLI

##### 3.1.1 Study Area

Study examined the barriers of existing learning management systems by case of convenience and snowball sampling technique, in higher learning institutions of Tanzania. Through snowball sampling technique 10 facilitators of online learning systems were identified from a convenience sampling choice of higher learning institutions of Tanzania, which in return associated their students and colleagues for further participation in the survey.

##### 3.1.2 To Identify Proactive Barriers through Related Works

This study, also based on bibliometric random literature review on the barriers that hinder the application and adoption of the existing open source LMSs in Higher Learning Institutions, in relation to facilitator's ability to engage in the use of the existing learning management system in their learning environment with students. The review led to the collection of empirical data of the most recognized barriers that hinder the use of the existing open-source learning management systems in Tanzania.

##### 3.1.3 Sampling Strategy

Sampling technic used were snowball and the case of convenience, whereas primal sample size recommended relevant and available sample size to partake in the survey, through online survey questionnaires and interviews, highlighting their experience with Online LMS, what kind of barriers they have encounter and probable recommendations (Amunkete *et al.*, 2019)

##### 3.1.4 Data Collection

A set of survey questionnaires and online interviews was conducted so as to attain barriers that would associate to their usage and experience with LMS under the researcher's supervision (Shayo *et al.*, 2017). This was conducted in the early of July 2020 to mid-August 2020.

### **3.1.5 Online Interviews**

The interviews involve a series of questions based on the particular topic so as to capture more details of user perspective with well-versed participants, allowing users to use any form of communication videoconferencing or simple call so as to make the participant comfortable and relaxed without inconvenience (Salmons, 2009; 2011).

This involved the primal sample size of 10 facilitators and 10 students representatively. Criteria for selecting the student was based on the referral technic or a snowball method from the primal facilitator, a student was recommended by the facilitator to partake on the interview given their relevance to the subject.

### **3.1.6 Data Analysis**

Using mixed methodology, a study offers both brief and detailed elaboration of different factors, making it more comprehensive and nearly impossible for misinformation since it carries out both quantitative and qualitative values (Bervell & Umar, 2017b). For the quantitative analysis a set of open and closed ended survey questionnaire were shared to users through a google form link tool and for the qualitative interpretation, interviews were commenced to acquire more details on particular queries through online interviews. R studio was used in the statistical analysis methodology, for both qualitative through descriptive analysis and quantitative through the character to factor method of analysis.

## **3.2 Implementation of Prototype**

Rapid Application Development was a suitable approach since it requires a completed workload and user feedback for continuous increments in changes (ICoSEEH, 2019). In implementing the initial prototype timely evaluation was scheduled to attain feedback from users and stakeholders in a selected team.

### **3.2.1 Tools**

#### **(i) MOODLE**

The Modular Object-Oriented Dynamic Learning Environment shortly for Moodle has an intuitive interface which allows addition of content and ease of navigation (Dougiamas, 2004). Besides being supported by any PHP run based systems such as Windows, Mac OS X, Linux

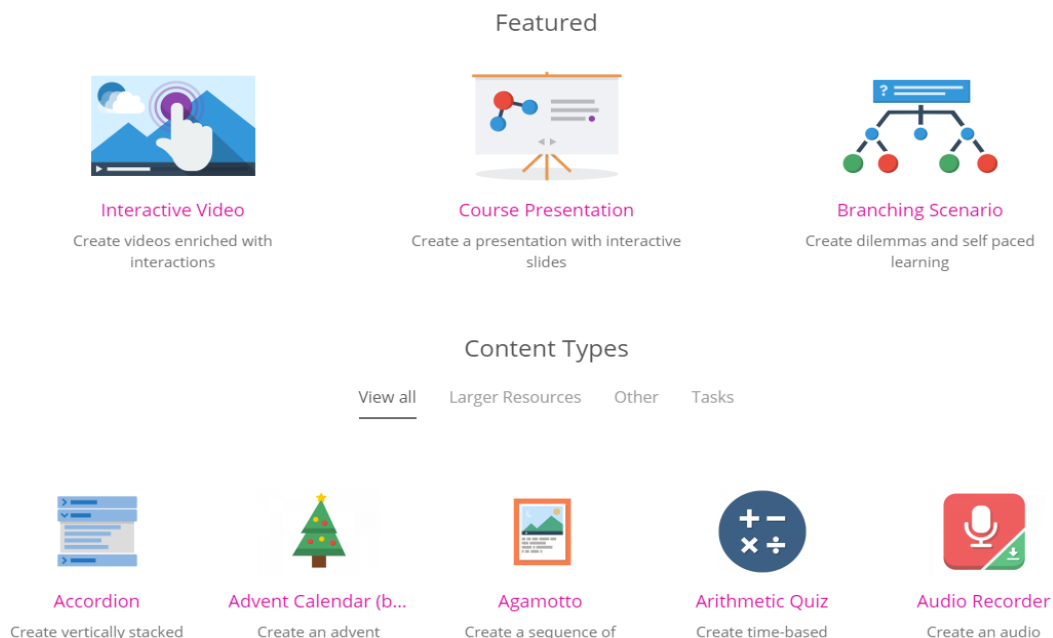
and Unix, Moodle platform is an open-source system which had been established by a group of programmers and owns an active and collaborative community of users (Brandl, 2005).

Moodle platform offers ease of resource integration since it's a web-based system comprising of PHP scripts stored in a Web-server with a database backend (Manson, 2008), this allows plugins and other resources to be created or added into the platform to satisfy user needs (Junne, 2020).

Moodle platform will be the based platform for customization, through its reformed functionalities such as database, features and compatibility, it will act as the platform for online learning tools to be integrated and exercised for interaction and improvement of user experience and usability testing.

## (ii) H5P

The H5P stands for HTML 5 Package, this is a powerful web-based content creation platform which comprises of XML scripting language and PHP. The H5P allows users to create, manage and edit contents in an interactive HTML5 activities for both academic and non-academic purposes (Centre, 2018). Figure 1, indicates the services used in creating interactive content and importantly offering assistive tutorials.



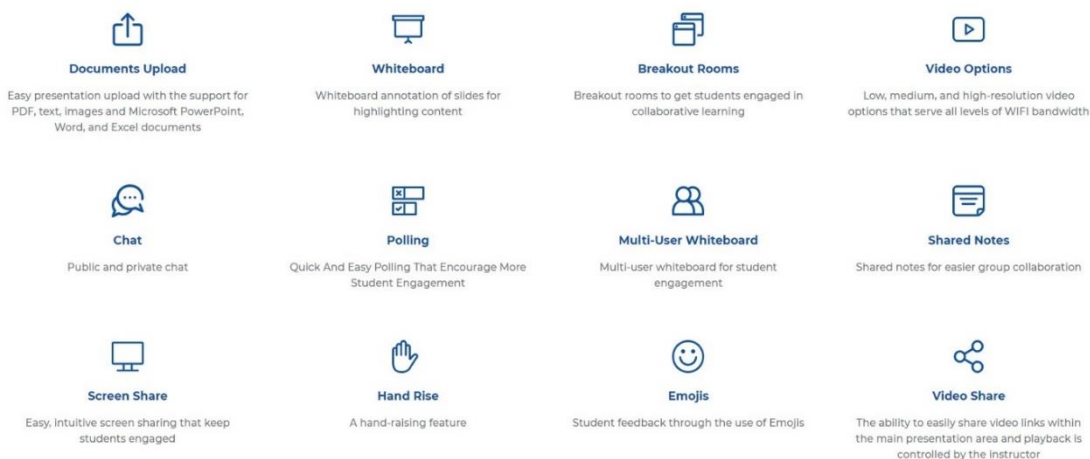
**Figure 1: Quotation of H5P Feature and Content Type from <https://h5p.org/>**

### (iii) BIGBLUEBUTTON

BigBlueButton is a video based synchronous online application, that has been used for video conferencing and allows customization and recording capabilities in real time (Dahlstrom-hakki *et al.*, 2020).

The architecture of the application made it easy to integrate with various LMS such as Canvas, Moodle and Blackboard such that the interaction of several components allows a set of features to take place (Ouya & Mendy, 2015).

Figure 2, quote the inbuilt features provided by the BigBlueButton and the technical know-how of each service.



**Figure 2: Quotation of BigBlueButton Features from <https://bigbluebutton.org/>**

### 3.2.2 Approach

Following the Rapid Application routine, sequence of activities was created in order to finalize the final prototype for study and users. Moodle LMS was installed on a local host computer then uploaded to a production server for customization and further integration procedures of online learning tools and improvements. Moodle LMS included features identified (Dougiamas & Taylor, 2003; Theses, 2015).

- (i) Forums and Chat
- (ii) Instant messaging and
- (iii) Announcements and assignments
- (iv) Calendar and quizzes

### (i) Sandbox to Production Server

As the initial prototype, Wamp server was installed and used in a local host in order to create the first “Jifunze kwa Moodle” prototype platform of a customized Moodle platform interface with two integrated online learning tools, H5P and BigBlueButton. Its compatibility with Microsoft’s Window operating system made it easy to navigate within the prototype and manipulate the platform. Wamp Server is made up of a web server called Apache, MySQL as a database management system and PHP as a server-side scripting language.

The Platform was then hosted by the A2Hosting services, these are United States based online hosting services. Accessibility through email authentication process or simply self-registration on site through <http://jifunzemoodle.com/> for users who had been geographically dispersed. This was the final prototype to be tested by users.

### (ii) Integration of Online Teaching and Learning Tools

H5P was firstly integrated into the system in order for the administrator to create interactive content for the users, this resource has new installments of modules after every update and it can accumulate 40 new content created concurrently (Centre, 2018).

BigBlueButton was then added into the system to promote synchronous , face to face online teaching sequence for the facilitators and students (Malone, 2015). The platform supported the distant learning scheme and available online for the dispersed users (Favale *et al.*, 2020).

## 3.3 Validation

After implementation of the prototype, facilitators and students had accessibility to the platform hosted online via a link, due to the disperse of participants. Table 1, indicates a series of activities were implemented to observe and ensure that the platform functions and interacts with users.

**Table 1: Process of Validation**

Stages	Phases	Activities
Initial	Logins and Audits	Login, Registration, setting profile, signing for course
Internal	Accessed services	Plugins, Resources, Calendar, Wiki, Forums and chats.
Later	Behavior of user	Course completion, Feedback, Survey and posted conversation

### 3.4 Summarized Framework of the Study

This section will summarize the framework of each specific objectives, methodologies, tools, inputs, outputs and flow of processes from each given activity. In Fig. 3, the labeled activities flows from A (start) to F (end), red boxed labels specify used tools, methods and techniques under the activity and the blue boxed labeled specifies results from each specific objective. Black labeled box specifies the start of a specific objective’s activity and the end of the specific objective, also it highlights data collected and the participatory sample size. Black arrows show the flow of processes from one activity to the other, whilst each activity’s input can become the other activity’s output variable. Lastly the image represents the resulted “Jifunze kwa Moodle” platform.

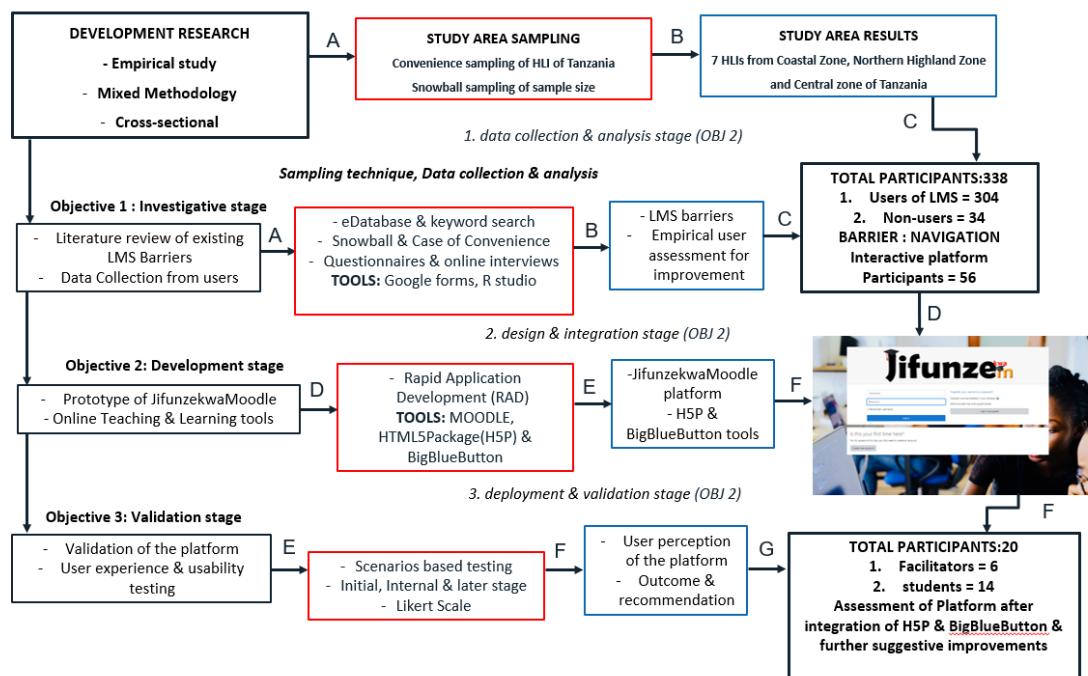


Figure 3: Framework of Study

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Data Sampling Size

This study applied convenience sampling of higher learning institutions of Tanzania, and through snowball sampling technique, the first 10 facilitators who participated in the survey associated their students and colleagues for further participation, therefore the study had achieved 338 participants inclusive of 112 facilitators/teachers and 226 students.

**Table 2: Classification of Regions into Zones and Allocated Participants for the Survey**

Zones	Regions	HLIs
Coastal Zone:	Tanga, Morogoro, Coast, Dar es Salaam, and Zanzibar	4
Northern Highland Zone	Arusha and Kilimanjaro	2
Central Zone	Dodoma and Singida	1
<b>Total</b>		<b>7</b>

#### 4.1.1 Participants of the Sample Data Collection

Table 3, shows the distribution of sample size from seven HLIs that had participated in the open and closed questionnaire digitally. Representatively, 57.1% from the Coastal Zone (n=4), 28.6% from Northern Highland Zone (n=2) and 14.3% Central Zone (n=1) of Tanzania.

**Table 3: Facilitators and Student Participants from Seven HLI**

HLIs	#1	#2	#3	#4	#5	#6	#7	Total
Facilitators	10	14	23	10	5	38	12	112
Students	16	16	40	15	35	75	29	226
<b>Total</b>	<b>26</b>	<b>30</b>	<b>63</b>	<b>25</b>	<b>40</b>	<b>113</b>	<b>41</b>	<b>338</b>

#### 4.2 Demographical Information of the Participants

This demographical information represented in Table 4, was collected from 338 participants from seven HLI's of Tanzania who had participated in the questionnaire, identifying the proactive barriers and mitigations. Respondents are still active in their respective institutions and hypothesis being that they are well familiar with the usage of electronic equipment such as

laptop, smart phones and other technic facilities because of their ability to assess the online questionnaire without difficulties.

**Table 4: Demographical Representation of the Sample Size**

<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>
Female	148	43.79
Male	190	56.21
<b>Total</b>	<b>338</b>	<b>100</b>

<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>
20 – 29 years	225	66.57
30 – 39 years	90	26.63
40 – 49 years	20	5.91
50 – 59 years	3	0.89
60 years and above	0	0
<b>Total</b>	<b>338</b>	<b>100</b>

<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>
Certificate	5	1.48
Diploma	50	14.79
Bachelor	188	55.62
Masters	77	22.78
Doctoral	18	5.33
<b>Total</b>	<b>338</b>	<b>100</b>

<b>Categories</b>	<b>Frequency</b>	<b>Percentage</b>
Facilitators	112	33.14
Student	226	66.86
<b>Total</b>	<b>338</b>	<b>100</b>

### 4.3 E-learning Users and Accessibility

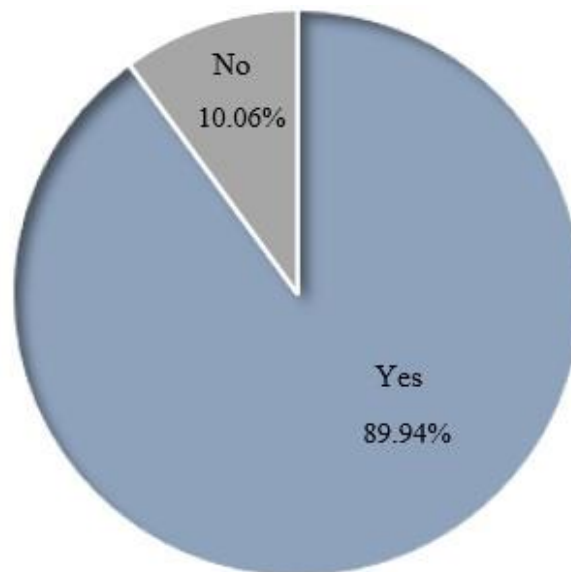
In this session user sample were evaluated for their use of E-learning systems and how did they access them. Hypothesis being that each participant had at least encountered a single online tool, system or resource that supported virtual studies and frequently used.

#### 4.3.1 Users of E-learning System from Sample Size

Figure 4, indicates 338 facilitators and students who partook the questionnaire, reflecting that 89.94% (n=304) have ever used an E-learning system with 29.59% (n=100) facilitators and



60.36% (n=204) students. Also, 10.06% (n=34) haven't used any E-learning system, with 3.55% (n=12) facilitators and 6.51% (n=22) students.



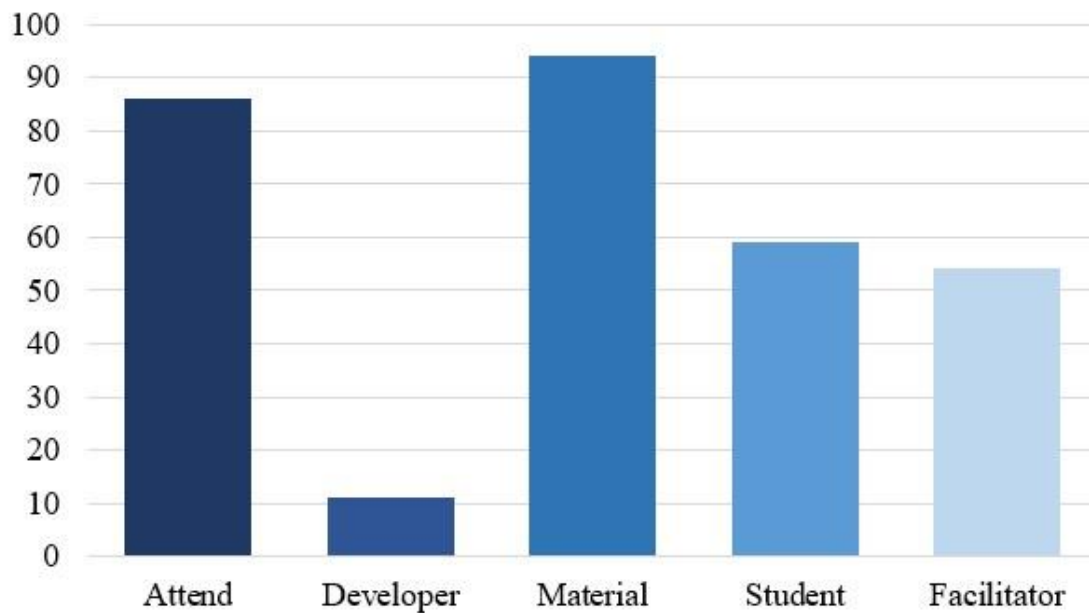
**Figure 4: Users and Non-users of E-learning Systems**

#### **4.3.2 How did Users Access the E-learning System?**

It's important to understand the "*how and why*" different user accessed the e-learning systems, there could be plenty of reasons but the summed up are five reasons that explicitly elaborate sample user's accessibility to an e-learning system in this study. Apparently, the first reason being simplified by abbreviations that stands for Attending/Attended an online workshop/seminar/ webinar/ course simply as "*Attend*".

Secondly, "*Developer*", stands for developer of e-learning systems hence the reason to how they have been able to encounter a LMS. Thirdly, "*Material*", this abbreviation stands for users who scavenge learning or teaching materials online hence encountered a few e-learning systems. Moreover, "*Student*", this stands for students who have LMS at their HLI thus have been able to access them through their academic institutions. Lastly "*Facilitator*", here this reason stands for facilitators who are conducting or have conducted a course virtually using an e-learning platform.

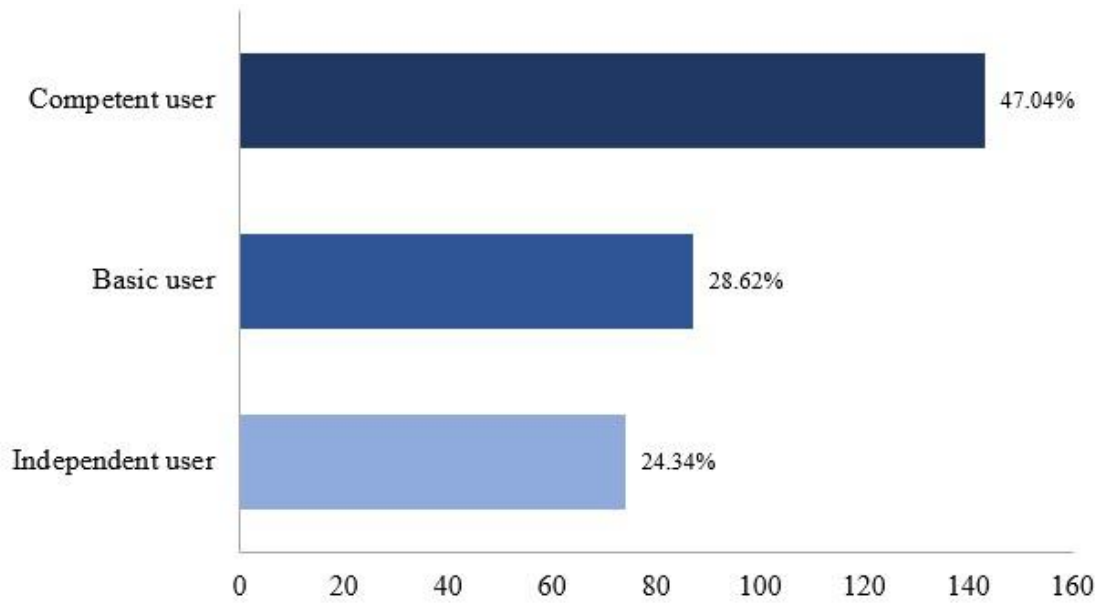
Figure 5, showcases the "*how and why*" the sample size was able to access the e-learning platform in different HLI of Tanzania.



**Figure 5: The “*how and why*” Users Access E-learning Systems in HLI of Tanzania**

#### **4.4 Digital Literacy of the Sample Size**

In categorizing participant’s digital skills, three options of were presented in the order of basic user, independent user or competent user. In Fig. 6, 28.62% (n=87) of the respondents were basic users meaning simple online surfing would be easy for them, and can access the internet’s services for instance emailing, social media and downloading and uploading files, 24.34% (n=74) of respondents categorized themselves as independent users, meaning they can easily navigate better on the internet than the basic user and most importantly can easily adapt with the changes that may take place with less assistance required, 47.04% (n=143) of respondents categorized themselves as competent users, meaning they are considered as the most competent digital users amongst the three, they are much advanced in using and adopting any information communication technology infrastructures.



**Figure 6: Digital Skills of Respondent**

In comparison of digital skills between facilitators and students in HLI's from the sample group. Facilitators had 51.05% (n=73) competent users digital skill set, this shows that facilitators have a high understanding of internet services and require less assistance in using of digital systems, 27.03% (n=20) were independent users and 8.05% (n=7) were basic users.

Students had 91.95% (n=80) basic user digital skill set, this represents that student can handle basic internet services such as surfing, emailing and google search but require assistance in using of digital systems, 48.95% (n=70) were competent users and 72.97% (n=54) were independent users.

#### **4.5 Identification of Existing Barriers in HLI of Tanzania**

First objective was to identify existing barriers of LMS in HLIs in Tanzania. This section discusses the existing barriers of LMS by users.

##### **4.5.1 Identifying Proactive Barriers of LMS in Tanzanian HLIs**

This section represents the data collected from 304 sample size of facilitators and students, thus presentation of the demographic details of users, the use of LMS in HLIs and still existing barriers will be assessed and results will be presented.

**Table 5: Learning Management System’s Barriers**

<b>Barrier</b>	<b>Frequency(n)</b>	<b>Percentage (%)</b>
Navigations	56	18.42
Bandwidth	42	13.82
Digital literacy	34	11.18
Perception	32	10.52
Policies	30	9.87
Information literacy	28	9.21
Compatibility	25	8.22
Technical training	22	7.24
Language	21	6.91
Credible content	14	4.61
<b>Total</b>	<b>304</b>	<b>100</b>

Table 5 represents users (N=304) who identified all barriers as proactive but at a different frequency rate, arranged in descending order that *Navigations 18.42%*, *Bandwidth 13.82%*, *Digital literacy 11.18%*, *Perception 10.52%*, *Policies 9.87%*, *Information literacy 9.21%*, *Compatibility 8.22%*, *Technical training 7.24%*, *Language 6.91%*, *Credible content 4.61%*.

**(i) Navigations**

Navigations variable represents the Navigational issues, such as lack of system interaction, system complexity and misrepresentation of contents. This variable relates to user experience issues and the inability to navigate within a platform.

Respondents highlighted that, “...*the appearance of the system was a problem in mobile phones, some materials where misplaced or funny looking...*”

“*I created a course two times, since I had no idea of how to delete my mistakes...*”

“*...Instead of sending a one-person message in chat I ended up texting all of people...*”

“*...we all had to manually register students in our courses that was a tough exercise.*”

“*... setting up a plugin and allowing students to use it was confusing at first...*”

E-learning platform should encourage user’s ability to interact with the system in the absence of assistance, catering to needs such as functional queries. This barrier has been reflected by

the 18.42% (n=56) of respondents, confirming that the risk of creating an E-learning system that doesn't consider interaction with the user can cause a simple task to be prolonged in completion, risen complains about system's complexity and abandonment of use.

## **(ii) Bandwidth**

Bandwidth variable represents the Lack of accessibility of the system due to network disruption and bandwidth expenses. Particular barrier has been reflected by the 13.82% (n=42) of respondents, currently accessing an e-learning system in their respective higher learning institutions in Tanzania.

A few respondents highlighted that, “... *a few years ago it was a major problem of network interruptions and sudden loss of network, which caused the LMS not be accessible...*”

*“... before I depended on the university internet now, I simply purchase my own internet...”*

*“...its sometimes costly to buy internet every day when you have small allowances...”*

*“...when it rains heavily sometimes the network gets distraught and the system will not be available if you had an assignment to submit, you will have to wait until it settles down and the network to come around ...”*

Lack of accessibility of the system on a timely manner tends to discourage users from using the system, loss of system relativeness and rendered obsolete.

## **(iii) Digital Literacy**

The ability to use an online system requires one to be acquainted with the applied technology. Highlighted by 11.18% (n=34) of the respondents.

A few respondents highlighted that, “...*we take technology for granted and therefore this digital literacy issue will never seize, even though technology has existed longer than that...*”.

*“Digital literacy is still a barrier because some staffers have aged in our HLIs and needing them to learn or rather adopt something new it's difficult...”*

*“I am not IT person but if something requires IT based learning then, more IT trainers should be involved...”*

Digital literacy demands the skillset attained willingly by a person, but it seems to be defined differently by respondents, who seem to believe that it's for the information technology's (IT) department to deal with and the use of age factor to escape learning new ideas.

#### **(iv) Perception**

Perception variable presents Perception of the end users, this barrier has been reflected by 10.52% (n=32) of respondents. Some users are fragile and a little bit of discouragement it affects their confidence and personal behaviors.

A few respondents highlighted that, *"I stopped using our LMS because our teacher provided the notes in class after lectures..."*

*"...once three teachers complained about the system in front of class, so that made me not comfortable to use again..."*

*"...system was loading so slow and it took a half an hour to open, so I stopped sending materials and so did my classmates..."*

In the Sub-Saharan countries such as Ghana, Nigeria, South Africa, Uganda, Kenya and Tanzania, the perceived ease of use of an E-learning system, promotes positive attitude towards acceptance and sustainability of an existing or applied system, otherwise consistent faced irregularities can affect user's perception and disrupt concentration and delay transactions.

#### **(v) Policies**

Policies is an item that represents the barrier of Policies towards E-learning acceleration and support, 9.87% (n=30) of respondents still believe that well formulated constitution and policies within HLI's that support E-learning adoption and application would change the wave of E-learning system survival.

A respondent highlighted that, *"...when our LMS stopped functioning there was no policy that supported it's revival..."*

Lack of policies towards E-learning acceleration and support, stipulates that creation and implementation of proper policies act as a positive reinforcement towards the achievement of sustainable E-learning systems.

#### **(vi) Information Literacy**

Inability to recognize or discover, assess, relate and acknowledge information has rendered much issues in the application and sustainability of existing E-learning system. Respondents have reflected it at 9.21% (n=28).

A few respondents highlighted that, “...students a fairly dependent on teacher’s materials even though they are in university...”

*“...I am afraid of allocating wrong materials, so I would rather wait until our teachers to give our class representative the notes ...”*

*“...tried using wikis in providing assignments and students complained that materials where exceeding...”*

Information literacy offers the ability of self-paced learning and self-efficacy, and students in HLIs require the freedom and encouragement of creating own content, that would suit their career choices without being subjected to redundant materials.

#### **(vii) Compatibility**

Compatibility is an item representing the Technological barrier, where 8.22% (n=25) of respondents reflected this barrier’s existence. Technological barriers include incompatibility issues that arise when an E-learning system is applied into a HLI and throughout infrastructures such as hardware and software, for a smooth operation.

A few respondents highlighted that, “...sometimes when I tried signing into the LMS it gave an error for almost a week, but it was due to updates issues as the IT department explained...”

*“...after the system was updated it crashed completely, the entire university had to look for alternative...”*

*“...installations took weeks since we had to change settings of the hardware and software to suit the system...”*

Before application of any LMS its best to conduct simple requirement analysis, this will decrease mishaps. Local hosting is the best way to avoid mistakes since one gain experience and awareness of how to exercise such a system before transferring it to the production server.

### **(viii) Technical Training**

This barrier has been reflected with 7.24% (n=22), showing that there is still a need of technical staffers and training that supports the application, and user familiarization with the E-learning system in HLI's.

Respondents also highlighted that, “...we didn't receive much training except system was online and everyone should register and join...”

*“I had to follow IT people whenever there was a problem, had to delay a session cause of that...”*

*“...my brother taught me and my friends at home how to use system but before I didn't know anything...”*

It's important to have trainers available so as to increase confidence in using LMSs, users who have been exposed to prompt assistance tend to have much appreciation of using the systems and can easily train their subordinates.

### **(ix) Language**

Language variable represents the Cultural indifference specifically language barrier. 6.91 % (n=21) of respondents still experience the language barrier thus making it difficult to adjust in using a system that doesn't facilitate ethnicity, lacking in the ability to cater for the cultural differences, due to implicit international standards.

This has caused most of the LMS to be represented in English language, whilst LMS with adaptive features such as additional language plugins, considering the end user's language could lead to the preservation of indigenous language and would have added value to the learners and improve social constructivism and a compatible way of communication within the E-learning system of a given community and the language they speak.

### **(x) Credible Content**

Credible content is a variable that represents the barrier of Insufficient content and credible resources, 4.61% (n=14) of respondents have identified that it is a barrier.



A few respondents highlighted as to why Credible content was still an affecting barrier, “...most of the materials are available online and are similar to the ones provided to use, so no new idea...”

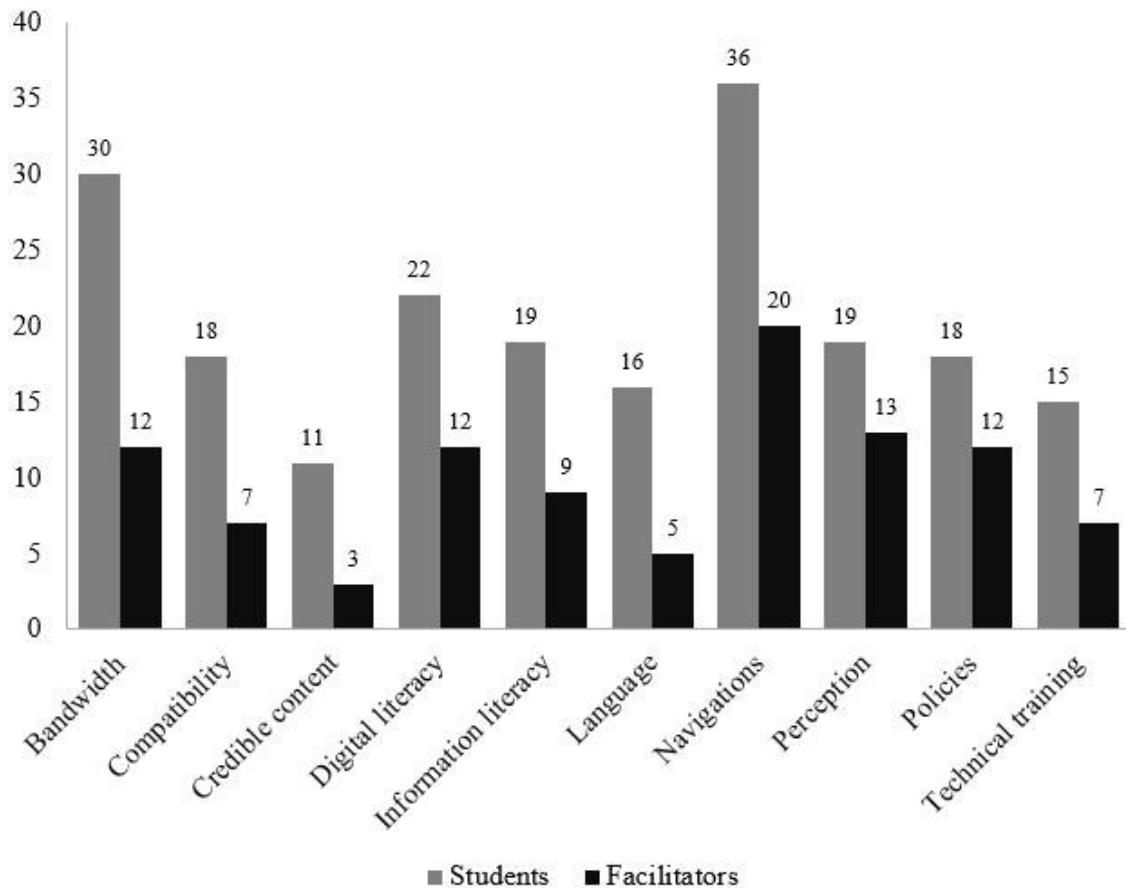
“...downloaded materials from system were pdf, word or ppt, it's like using normal email...”

The highlights show that students frequently receive notes that are similar, hence find no need of using a system that provides them with alike materials from online sources. Insufficient content in a LMS tends to exhaust resources such as server space and bandwidth without fulfilling ultimate goal.

#### **4.5.2 The LMS Barriers Affecting Facilitators and Students**

Figure 7, highlights the 33.14% (n=100) of facilitators that have access to an existing system have reflected barriers that are still affecting their use of E-learning system are Navigations 20% (n=20), Perception 13% (n=13), Bandwidth 12% (n=12), Policies 12% (n=12) and Digital literacy 12% (n=12) which were all above 10% (n=10). Information literacy 9% (n=9), Compatibility 7% (n=7), Technical training 7% (n=7), Language 5% (n=5), Credible content 3% (n=3) which were below 10% (n=10).

Also, Fig. 7 highlights the 66.86% (n=204) of students that have access to an existing system have reflected barriers that still affect their use of E-learning systems are Navigations 17.6% (n=36), Bandwidth 14.7% (n=30), Digital literacy 10.8% (n=22) which were all above 10% (n=20). Perception 9.3% (n=19), Information literacy 9.3% (n=19), Policies 8.8% (n=18), Compatibility 8.8% (n=18), Language 7.8% (n=16), Technical training 7.4% (n=15), Credible content 5.4% (n=11) which were below 10% (n=20).



**Figure 7: LMS Barriers Affecting Facilitators and Students**

#### **4.6 Input on the Success Factor of the Platform from Users**

The “Jifunze kwa Moodle’s” initial prototype without customization, had been reviewed by administrator and team to achieve the final prototype with suggestions from users during the online interviews. Such increments were the key aspects that facilitators and students from the sample, considered as the success factor for solving the barrier. Table 6, aligns a few comments from the interviews that had led to the integration of online teaching and learning tools that sufficed the required team.

**Table 6: Input for Success Factor from Users**

<b>Profession</b>	<b>Aligned comment from users</b>	<b>Users</b>
Facilitators	<i>“As a teacher, I want to engage with students in provided content”</i>	5
Students	<i>“Even if am using an online platform, I sometime want to see the teacher face to face”</i>	11
Facilitators	<i>“Face to face and instructiveness”</i>	5
Students	<i>“I like interactivity in a lesson”</i>	8
Facilitators	<i>“If game-based learning is promoted maybe I will use”</i>	4
Students	<i>“I don’t know maybe if I see the platform first”</i>	6
Facilitators	<i>“shortcuts for the navigations will do it”</i>	3
Students	<i>“more informative ways of communication rather than just pdf”</i>	6
Facilitators	<i>“IT can come up with best solution”</i>	3
Students	<i>“at the end administrator can fix anything”</i>	5
<b>Total</b>		<b>56</b>

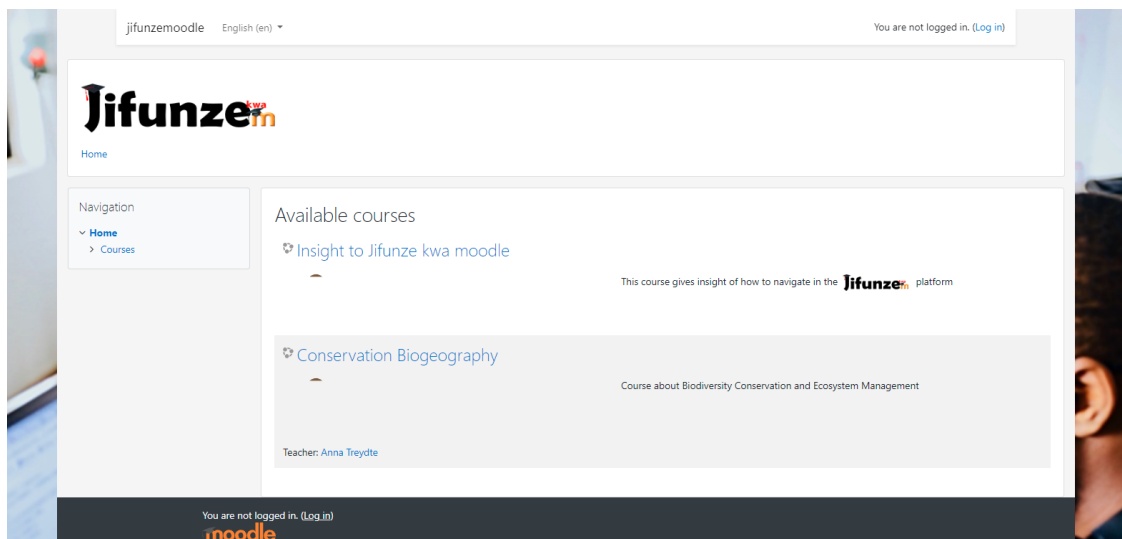
#### **4.7 Implementation of the Prototype**

Creation of Sandbox on a Window operating system, allowed the manipulation of the Moodle 3.9.2 in order to acquire stakeholders needs. The system is equipped with usability and its required addition interactivity to facilitate content creation and face to face exchange.

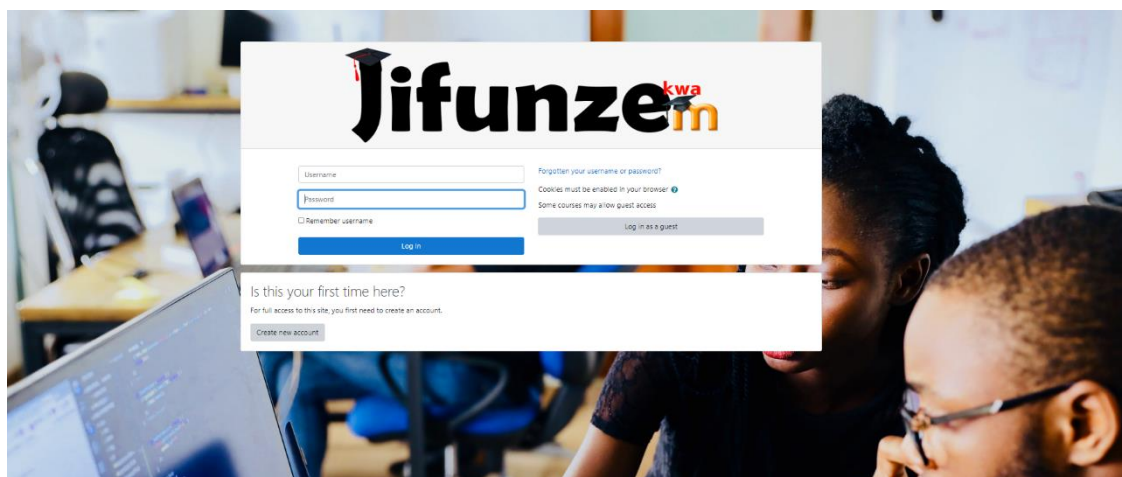
##### **4.7.1 “Jifunze kwa Moodle” Platform**

“Jifunze kwa Moodle” platform, is a customized Moodle LMS with the integration of two online teaching and learning tools, these tools offer powerful content creation capabilities and autonomous online learning. This platform was used as a testing environment for how online tools can bring about interactive learning and promote distance learning.

Facilitator and student would access the platform, by creating an account and then login using their usernames and password. Figure 8 and 9 indicates the home page and login page of the “Jifunze Kwa Moodle” platform and courses visible to the public.



**Figure 8: Home page**

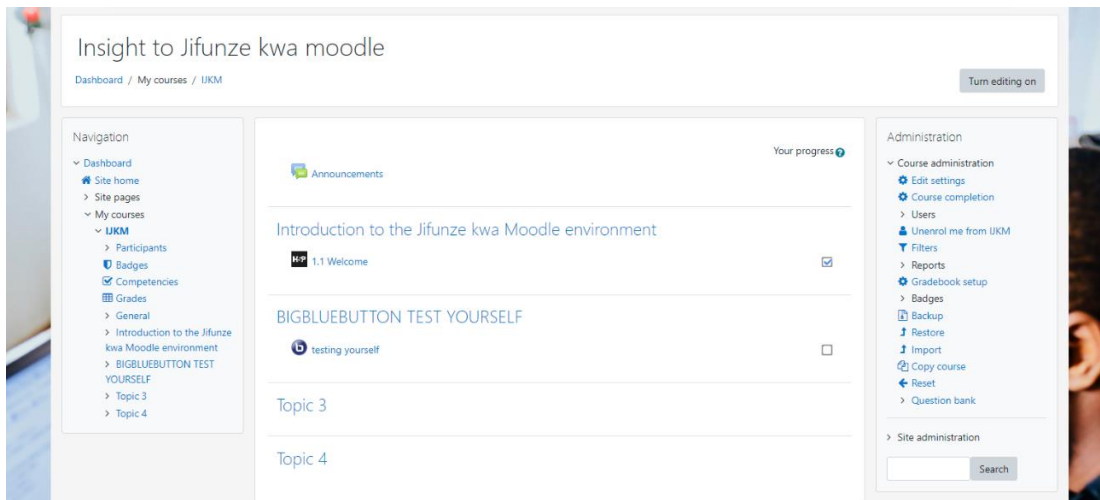


**Figure 9: Login and Registration Session**

#### **4.7.2 Application of Online Teaching and Learning Tools**

Integrating H5P for content creation. H5P supported the creation of different interactive contents for the students whilst making the whole experience for the facilitator comprehensive, it become easy to make a game-based content for the students.

Integrating BigBlueButton for synchronous virtual transaction. BigBlueButton was the prior video conferencing tool used and it made the communication of users easier.

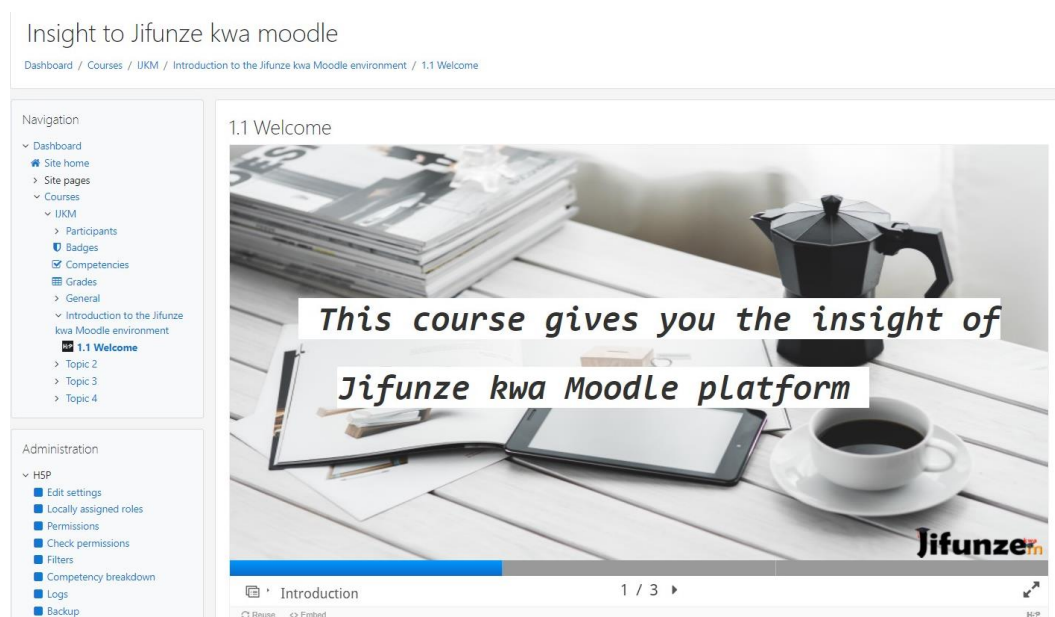


**Figure 10: Course Created by the Integrated Tools**

#### 4.8 Validation

The study involved 18.5% of user (n=56) who had collaborated on the questionnaire and selected the Navigation barrier and interviewed to attain more details upon the improvement. A link to the platform was shared but 55.56% of user (n=30) enrolled that is 10 facilitators and 20 students, but 20 users had accomplished the tasks assigned, thus 6 facilitators and 14 students.

Using the H5P Course presentation, interactive videos and branching scenario the platform had created a preliminary short course that would assist users in their navigation of the platform and BigBlueButton shown in Fig. 11.



**Figure 11: Introductory Course for the Platform**

#### 4.8.1 User Assessment of the Platform

Study analyzed general aspects of the platform so as to identify the missing loops in the platform and make incremental adjustments.

##### (i) Usability of platform was satisfactory

Conducted tests on the usability of the platform, was done in sequence of activities so as to assess the platform's functionalities. The test included two phrases the logins and audits and accessed services within the platform. Login and audits involved user registration, login, setting up profile and signing up for a course. Accessed services involved use of plugins, resources and other services such as calendar, wiki and forums.

##### (ii) User experience was sufficing

Tests conducted on the platform was in observing of users' behavior within the platform. Behavior of user was the third phase of testing user experience of the platform through a series of activities such as the completion of the intended course, user feedback, survey and posted conversation in the chats and forums. As it may have appeared they were less assessment raised about the platform's interaction with the users.

##### (iii) Creation of content for facilitators using H5P

Creation of content using H5P was an activity that was to assess the usage of facilitators and their comfortability in using the platform in sharing the contents. This is the evaluated feedback presented from this activity. Table 7, shows that H5P features were useful in easing content creation, especially the usage of course presentation and interactive video which were positively assessed by facilitators. Branching Scenario was a bit of a pickle but this would simply require more self-training.

**Table 7: Validation criterion for H5P**

<b>Validation criteria</b>	<b>Facilitators</b>	<b>Easy</b>	<b>Not Easy</b>	<b>Neutral</b>
<b>Course Presentation</b>	100%	83.33 %	---	16.67%
<b>Branching Scenario</b>	100%	50%	33.33%	16.67%
<b>Interactive video</b>	100%	66.67 %	10%	23.33%

**(iv) Hosting a virtual class for student using BigBlueButton**

BigBlueButton tool was useful in the promotion of face-to-face interactions within the platform and made it easy to use. Table 8, highlights both facilitators and students seem not to have issues with how this tool engaged with them during their assessment of the platform.

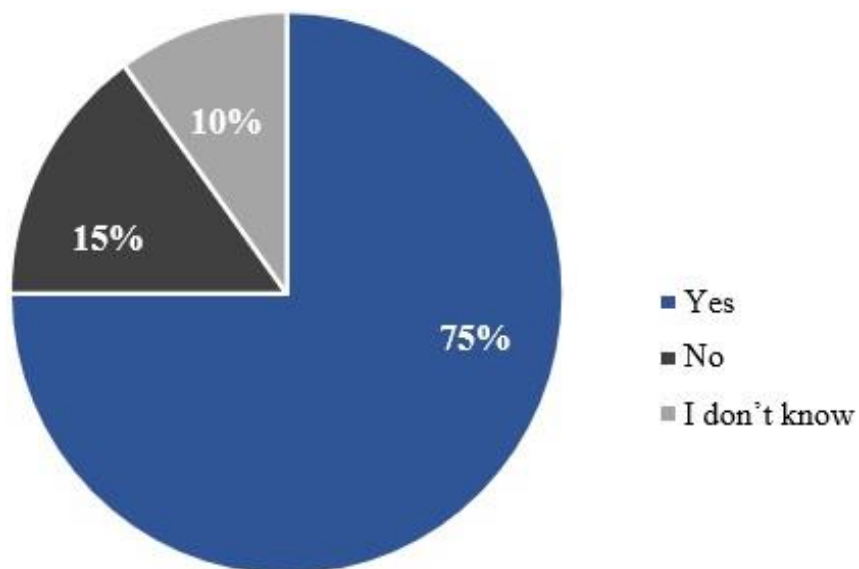
**Table 8: Validation Criterion for BigBlueButton**

Validation criteria	Participants	Easy	Not Easy	Neutral
Hosting virtual class	Facilitators	83.33 %	---	16.67%
Participation	Students	86.67%	---	13.33%

**(v) Positive User assessment on the use of H5P and BigBlueButton**

Participants of the platform were enthusiast with how the H5P and BigBlueButton operated though not all participants had completed the assigned activities.

Figure 11, highlights that 75% of users combined had a positive reaction towards the platform while 15% had short comes with the platform and 10% of users didn't know what to respond to the assessment.



**Figure 12: Positive Reaction Towards “Jifunze kwa Moodle”**

#### **4.8.2 Improvement Areas for the Study**

**(i) There is a Need for More Training for the Teaching and Learning Tools**

Technical know-how is important in assist new users in a platform. 33.33% facilitators had highlighted that using branching scenario in H5P wasn't easy and 10% of facilitators has elaborate the same remark about interactive video. More authoring training videos are to be researched, created and tuned to assist the platform users.

**(ii) Additional Materials and Services for the Platform to Become More Relevance**

Students enjoyed the tour within the platform but as predicted there wasn't enough materials to benefit their interest given the dispersement of sample group from different places and HLI.

**(iii) Interactive learning is a prolonged term of endurance**

Catering to facilitator's needs such as which tool to use and how to use it will assist in content creation that a fun and interactive for their sessions. In order for a platform to become relevant, facilitators have to embrace the platform and motivate usage of the platform to their students.

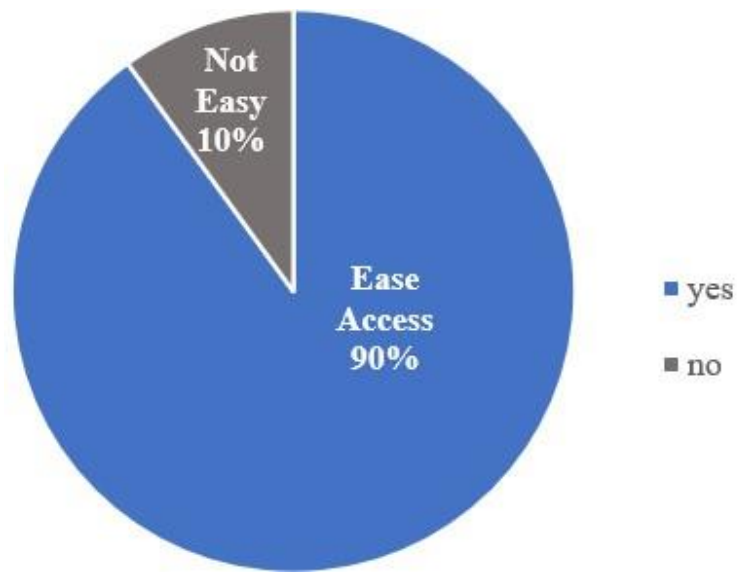
**(iv) Dispersement of the sample size**

The study had a dispersed sample group that had to be coordinated virtually in using the platform. Basically, if there was a singular group of users from a given institution it would have been highly effective to attain a systematic and controlled method of evaluation.

#### **4.8.3 Benefit of the Study**

Accessibility of the platform was fast, 90% of users had no issues of how to access the platform whilst 10% of users had issues with bandwidth and personalized short comes. Figure 13, highlights that if a platform is easily accessed by users, it promotes a positive perception of usage and less complication. Users with difficulty in accessing LMS tend to procrastinate the usage and cause negative perception.





**Figure 13: Analysis of the Platform's Accessibility**

## CHAPTER FIVE

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 Conclusion

This research study analyzed existing barriers of LMS's systems that affect both facilitators and students in HLIs, and implementing various approaches to create conducive environment for them to be interactive and relevant. To determine proactive barriers of LMS, a review of previous studies highlighted various barriers affecting both facilitators and students and these barriers were evaluated by users of LMS in HLI's and proactive issues of were Navigation, Bandwidth, Digital literacy, Perception, Policies, Information literacy, Compatibility, Technical training, Language and Credible contents.

Applying rapid application development, an existing LMS, Moodle was used to improve stakeholder's concerns with navigational issues, and misrepresentation of contents. Moodle platform being open source and with ease integrational structure offered the best ground to test different approaches to improve user experience and create interactive ambience for both facilitators and students.

In order to improve user experience for facilitators, this meant ease and interactive approach in creating sessions and promotion of face-to-face interaction with their students. Using H5P and BigBlueButton resources integrated into the Moodle platform, thus prototype of "Jifunze Kwa Moodle" platform was created. Both facilitators and students confirmed that the "Jifunze Kwa Moodle" platform has sustained in keeping things interactive due to the materials provided by the facilitators and regular enquires of user feedback.

#### 5.2 Recommendations

This platform has confirmed that to improve application and adoption of any existing LMS such as Moodle, it requires more investment in finding more resources that a compatible and relevant with the needs of stakeholder at present. Using H5P and BigBlueButton was an initial eye opener to the fact, that there should be system reviewers who would evaluate the usability and the level of user experience of the system after deployment so as to decrease the probability of having an obsolete LMS in a HLI.

The LMS was well appreciated by the facilitators and students due to the introduced resources that have assisted in making their sessions more interactive and easier. This was then highlighted that a few of the LMS in HLI aren't updated on time and some tend to be difficult to access due to other issues, such as network disruptions and low bandwidth therefore other barriers are to be managed internally by the HLI.

Further research can consider features that occur in particular HLIs in order to observe significant reasons of an obsolete LMS. Recommendable future studies in LMS sustainability, should be conducted in order to ensure relevance of the system by improving, user experience of LMS in Tanzanian HLI.

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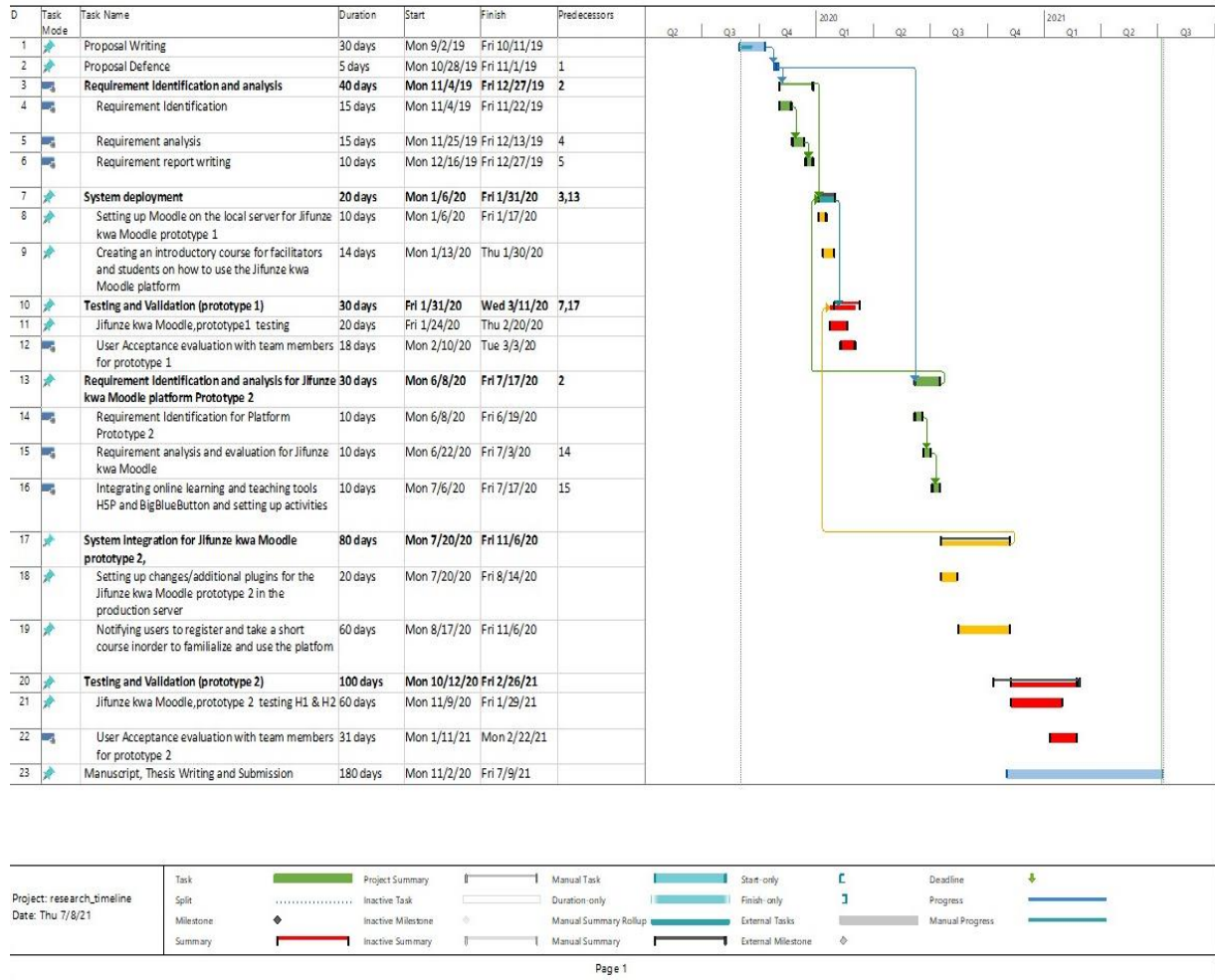


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# APPENDICES

## Appendix 1: Research Timeline



## Appendix 2: Research Budget

The research budget estimate will be addressed as the following (in TZs.)

The NELSON MANDELA AFRICAN INSTITUTION OF SCIENCE AND TECHNOLOGY					
Research Title: Usability and user experience of Moodle learning management system into Higher Learning of Tanzania					
Name of Student: Doris Mwendwa					
RESEARCH BUDGET					
Activity	Input description	Unit of Measure	Unit Cost	Number of units	Amount to Student
<b>1. Data collection</b>	Per diem for student	Day	80,000	10	800,000
	Per diem for supervisor	Day	100,000	10	1,000,000
Subtotal					1,800,000
<b>2. Software integration and deployment</b>	Laptop, Core i7, 16 GB memory	Computer	800,000	1	800,000
	Software License				
Subtotal					800,000
<b>3. "Jifunze kwa Moodle" testing and validation through H1 &amp; H2</b>					
3.1 Prototype 1	Software and Hardware	30 days	5000	150,000	150,000
3.2 Prototype 2	Software and Hardware	100 days	5000	500,000	500,000
Subtotal					650,000
4. Publication	Paper publication		1000,000		1,000,000
	Dissertation printing and binding		300,000		300,000
Subtotal					4,550,000

### Appendix 3: Research Questionnaire

Sample Questionnaires.

These serve as a general questionnaire of the primary data to be collected from you (respondent), kindly consider taking 10 minutes of your time to answer them briefly. Mark with a (√) in the most relevant choice(s).

(i) What is your gender?

(i) Female

(ii) Male

(iii) What is your Age?

(iv) 20 – 29  
years

(v) 30 –  
39 years

(vi) 40 - 49  
years

(vii) 50- 59  
years

(viii) 60 and  
above

(ix) What is your current highest academic achievement?

(x) Certificate

(xi) Diploma

(xii) Degree

(xiii) Masters

(xiv) Doctoral

(xv) What is the major of your current highest academic achievement?

.....

(xvi) What is your profession at your institution?

(xvii) Teacher

(xviii) Student

(xix) Researcher

(xx) Have you ever used an E-learning system? If your answer is No, please skip to Question 11.

(xxi) Yes

(xxii) No

(xxiii) Can you generally describe your experience with E-learning systems?

(xxiv) Great

(xxv) Positive Normal

(xxvi) Negative Normal

(xxvii) Worst

(xxviii) Please select or mention only one E-learning system that you are most active and comfortable with.

(xxix) Moodle

(xxx) Blackboard

(xxxi) Canvas

(xxxii) Others

.....

(xxxiii) How did you come to access the E- learning system identified above? Select all relevant choices.

(i) Attending / Attended a short-term online course

- (ii) I am Student at the institution that prescribed the E-learning system
- (iii) Material scavenging online such as tutorials and notes for personal use
- (iv) I am teaching / taught a course using E-learning system.
- (v) What was the nature of the E- learning system you had accessed? After responding, please skip to Question 12.

- (vi) Interactive and satisfying
- (vii) Good, I would want to try again
- (viii) Okay, but won't use it again
- (ix) Complex and disoriented
- (x) Would you want to learn about E-learning systems? If your answer is No, please skip to Question 13.

- (xi) Yes
- (xii) No

(xiii) What best describe your level of experience in using the E-learning system per say?

- (xiv) Professional and a frequent user
- (xv) Can operate but require limited assistance
- (xvi) I need a preliminary training and assistance
- (xvii) Novice, need a compulsory training and frequent assistance

(xviii) What most likely are the causes of the previous response? Select all relevant choices

- |                                    |  |
|------------------------------------|--|
| (i) Information Literacy           | (ii) Type of E-learning system and compatibilities, hardware availabilities. |
| (iii) Digital literacy             | (iv) Technical training and assistance                                       |
| (v) Perception of the instructor   | (vi) Network infrastructure and Internet bandwidths issues                   |
| (vii) Language                     | (viii) Navigation and content representation (usability)                     |
| (ix) Policies Available            | (xi) Others  |
| (x) Content and credible resources | .....  |

## **Appendix 4: Online Interview Guide**

### Part A: Facilitators

- (i) Elaborate short comes of Navigational barrier in teaching an online classroom?
- (ii) What would you recommend to eradicate stated barrier?
- (iii) What tool(s) do you use to promote interactive content creation in an online platform? (How often do you use this tool to date?)
- (iv) What tool(s) do you use to promote online face to face classroom (synchronicity)? (How often do you use this tool to date?)
- (v) What challenges do you face in using such tools

### Part B: Students

- (i) Elaborate short comes of Navigational barrier in taking an online classroom?
- (ii) What would you recommend to eradicate stated barrier?
- (iii) What tool(s) used in class to promote interactive classroom?
- (iv) What challenges do you face in using such tools

## Appendix 5: Usability and User Experience

Facilitator and students had to go through a series of activities and check if the platform performed properly.

Stages	Phases	Activities
Initial	Logins & Audits	Login, Registration, setting profile, signing for course
Internal	Accessed services	Plugins, Resources, Calendar, Wiki, Forums and chats.
Later	Behavior of user	Course completion, Feedback, Survey and posted conversation



## RESEARCH OUTPUTS

### Published Article (Book Chapter)

#### **Analyzing Learning Management System's existing barriers affecting facilitators and students in Higher Learning Institutions of Tanzania**

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#### **Abstract**

Learning Management systems (LMSs) are the pinnacle of all learning in the 21<sup>st</sup> century, with their availability and application on demand. After application, a number of e-learning systems have lost relevance and are rendered obsolete due to complained barriers even after a few updates have been conducted.

This research applied a qualitative analysis to identify the still proactive barriers of LMS's, a study case of seven Higher Learning Institutions in Tanzania. The affecting barriers identified by literature were accessibility of the system due to network disruption and bandwidth expenses (Bandwidth), Digital literacy, user's perception towards the use of an online LMS in taking a course (Perception), policies towards E-learning acceleration and support (Policies), Information literacy, technological barriers (Compatibility), lack of relevant technical training and assistance in using LMS for the instructors (Technical training), LMS's lack the ability to cater for the cultural differences (Language), navigational issues, and misrepresentation of contents (Navigations) and insufficient content and credible resources (Credible contents).

Sampling technic used were snowball and the case of convenience, whereas primal sample size recommended relevant sample size to partake in the survey, through online survey questionnaires and interviews, which included 338 participants inclusive of 112 facilitators/teachers and 226 students. This paper will analyze and identify the still existing LMS barriers affecting facilitators and students in the higher learning institutions (HLIs) of Tanzania.



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