THE UNIVERSITY OF ZAMBIA

School of Education

Department of library and information science

Project in Information and Communication Technologies (ICT 4014)

Group project report

Title**:**

Investigating and comparison of Affordances on popular Open Source Learning Management Systems and undergraduate students' usability evaluation of Moodle at the University of Zambia.

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ABSTRACT

Many educational institutions are nowadays integrating the traditional face to face instruction methods with the online which can be synchronous and/or asynchronous. Synchronous learning means that although you will be learning from a distance, you will virtually attend class sessions each week, at the same time as you're the instructor and classmates while asynchronous learning is a general term used to describe forms of education, instruction, and learning that do not occur in the same place or at the same time. It uses resources that facilitate information sharing outside the constraints of time and place among a network of people. LMSs are standardized platforms that are selected from broad categories and used in education institutions to support both synchronous and asynchronous methods of teaching and learning. Selecting the best LMS can be determined and directed by factors such as the type of usage, the type of users, functionality of the system, the needs of the system users and financial resources available for the system, just to highlight the main ones. However usability and functionality are key in the selection process. This study employed document and system analysis to uncover the affordances available of popular free and open source LMSs; Atutor, Chamilo, Sakai Moodle and Canvas. The results showed that there are teaching and learning features that can be considered as integral and must have when choosing an LMS. The results also showed that each of the five LMSs does have feature that may and/or may not be available on the other four LMS. The results showed further that the LMSs may and/or may not support a particular feature using external plugins and third party software.   This study made use of the System Usability Scale (SUS) to determine the student's usability evaluation of Moodle at the University of Zambia. An experiment was set up where participants were required to perform tasks on Moodle after it was installed and set up on a Cloud server, after which each of the participants responded to the SUS in <u>Appendix C</u> which helped to understand the undergraduate student's usability evaluation of Moodle LMS. The results showed that

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CHAPTER 1

INTRODUCTION

In an age when the education system is digitizing academic activities, there has been an increase in the number of e-learning systems which provide academic institutions with a variety of options to choose from, this is often a tedious process to education administrators who may be new to the virtual learning environment. The institutions considering the use of a virtual learning system need to know the effectiveness of the available learning management systems (LMS) open to the public and also its strengths and weaknesses (Alturki, 2016). Open source systems have in the most recent past become very important tools in education. Free and open source LMSs in simple terms are LMSs that are made freely available to the general public for usage and/or modification if need be (Zarina et all, 2020). There are so many open source LMS's available to the public, now each of these has its strengths and weaknesses, it is for this specific reason that it is important for a prospective user to be well informed in order to make the best selection from this broad array. Making the right choice while selecting an LMS is necessary in order to select the best system that will meet the institutions needs effectively without compromising on the institutions goals and objectives.

World over there has been a fast passed transition from the standard classroom paper based textbook and handouts which are no longer the most reliable way to administer and facilitate learning in order to realize the objectives of education. In a technologically driven economy online learning which is specifically called e-learning has now become a house-hold term, as it has become the most prominent method of distance education. E-learning refers to teaching and learning that is conducted over the internet using tools that enable such activity (Denan etal, 2020).

1.1. PROBLEM STATEMENT

The University of Zambia has unanimously adopted and implemented three (3) free and open source (FOS) LMSes to enable its online courses administration possible, these are Canvas overview, Moodle and Google Classroom. However, on a lighter note, it is not clear how the university is coping up using these platforms, in terms of ; what features the stuff are finding very useful?; which features stuff is facing challenges to handle? ; And which feature are missing from

any of the three above mentioned LMSs? ; And on a higher note which platform stuff finds more effective hence giving it preference over the three? The aim of this study is to discover the teaching and learning features available of popular free and open source (FOSS) LMSs and understand the UNZA undergraduate student's evaluation of Moodle.

1.2. OBJECTIVES OF THE STUDY

1. To determine the affordances available on popular Free and Open Source (FOSS) LMSs.

2. Investigate the University of Zambia student's usability evaluation of Moodle.

3. Understand the undergraduate's usability evaluation of Moodle.

1.3. RESEARCH QUESTIONS

1. How do the features of each LMS compare to those of other LMSs?

2. How effective can each LMS be to teaching and learning process?

3. How do the students evaluate the use of Moodle at the UNZA?

1.4. SIGNIFICANCE OF THE STUDY

In view of the shift that educational institutions are undertaking which is involves migrating from heavily relying on the traditional way of conducting teaching and learning activities to the blended way which is characterized by the integration of LMS to make possible e-learning, it is vital that educational administrators understand the extent to which the LMS chosen for institutional adoption can meet the educators and leaners needs. This calls for thorough understand of the features and available and/or absent on a particular LMS. Furthermore it is vital to understand how the students evaluate the usage of Moodle at the UNZA as it will help management to understand the challenges that students are facing using the platform as it is, more than ever before, being utilized by faculty to administer courses. This will feather help in coming up with changes that need to be made to mitigate the existing challenges among students utilizing the system.

1.5. ETHICAL CONSIDERATIONS

The researchers strictly followed research ethical guidelines in order to ensure credibility of the research results. This research's participants were free to opt in or out of the study at any point in time during the data collection process. Participants were made to know the purpose, benefits and risks behind the study before they agree or decline take part in the study. Personally identifiable of the participants will be kept private and not used anywhere outside the scope of this research. The researchers ensured that this work is free from plagiarism or research misconduct, and we accurately represent the results of the research.

1.6. DEFINITION OF KEY TERMS

Learning management systems (LMSs): A learning management system (LMS) is a software application or web-based technology used to plan, implement and assess a specific learning process. Typically, a learning management system provides an instructor with a way to create and deliver content, monitor student participation and assess student performance. (Ali and Mbabazi, 2016).

E-learning: E-Learning is learning utilizing electronic technologies to access educational curriculum outside of a traditional classroom. In most cases, it refers to a course, program or degree delivered completely online (Zarina etal, 2020).

Usability: Usability is a measure of how well a specific user in a specific context can use a product/design to achieve a defined goal effectively, efficiently and satisfactorily. (Achchuthan etal, 2015)

CHAPTER 2
RELATED WORK

2.1. Popular LMSs and their associated features

Traditionally, the teacher and the student need to meet in person for teaching and learning to take place. In the modern academic world, however, the classroom-based model may no longer be as efficient on its own. To remain relevant and keep pace with the evolving arena, schools have to incessantly implement physical learning and e-learning as part of a blended approach. For new

learning strategies to work successfully, the use of unique initiatives and software programs has become paramount. To administer online lessons schools require specialized software designed just for this purpose. A lot of different LMSs do exist for usage out on the software market. Each meeting specific needs of a particular target audience, thus the need for proper evaluation of an LMS to ascertain to what extent it can meet the need of particular users and also to ensure its effective implementation.

First and foremost, the first LMS was developed in 1924 when Sidney Pressey invented the first 'teaching machine. According to Beetham and Sharpe (2007) a Learning Management System (LMS) may be defined as a virtual environment that aims to simulate face-to-face learning environments with the use of Information Technology. In an LMS, the interaction happens through devices that enable communication, allowing the creation of different strategies to encourage a dialogue and active participation of students. They add that Learning Management Systems are web-based systems that enable teachers and students to share materials, to submit and return assignments and to communicate online. On the other hand Al Marashdeh et al. (2011) point out that an LMS is software used to plan, implement and evaluate a specific learning process.

A learning management system offers a large and indispensable continuum of features to support a range of educational activities depending on which platform you are using, all that are aimed at aiding supplementary and/or complementary means to facilitating learning in order to meet education objectives. Properties that are termed as affordances. It may be that the term "affordances" is simply a new term for a concept that had previously been explained in different ways. For example, Ally and Mbambazi (2016) described the idea of different technologies having particular attributes providing specific opportunities but did not use the term "affordances." However, it can also be argued that the term might also usefully provide a new perspective for conceptualizing the role of online technologies in education. This acknowledges how technologies are intricately related to the many other elements of the learning context that can shape the possibilities they offer to learners, the way learners perceive those possibilities, and the extent to which the possibilities can be realized.

Denan et al (2020) postulates that LMSs offer a variety of content development and delivery methods automate the process of student enrollment, management of records, reports, transcripts, and schedules. They also incorporate evaluation, assessment, and testing capabilities. The

important braod function of an LMS is to provide support for interaction between participants through discussion board, chat, e-mail, and instant messaging as well as a mechanism to tracking student activity, and monitor their progress (Onacan M. and Erturk, 2016).

The benefiting users of LMSs can be classified into three categories: learners, instructors, and administrators (Arsenovski et al, 2008). Learners are the main users of the LMS. Different features of LMS could facilitate student learning and increase their engagement to online courses. They interact with instructors and other students by using synchronous and asynchronous communication tools. Polizzi (2020) suggests that a safe and supportive atmosphere for learning motivates students and results in improved learning outcomes. Instructors use the system to create and present content, provide interaction opportunities, and evaluate the students' performance and provide feedback. Finally, administrators are responsible for managing the users of the LMS - learners and instructors, monitor the operational status of the system, and solve technical issues (Ivanović et al, 2013). Ibid asserts that most LMSs mostly include the features that can be classified as content development tools, communication tools, productivity tools, and student involvement tools:

- Synchronous communication: real-time virtual classrooms with two-way voice,
- multipoint video, interactive whiteboard, application sharing, or file transferring
- Email: sending and receiving messages internally (within the LMS / externally)
- Discussions: posting questions and responses in a discussion board
- Calendar: schedule and share events and deadlines
- Blog: online journaling and reflection
- Instant messaging: sending private text messages to other users of the LMS
- Quizzes: online quizzes with a variety of question types
- Surveys and polls: receiving feedback from users
- Dropbox: submission of individual and group assignments
- Rubrics: definition of assessment criteria to provide structured feedback
- Gradebook: a grading system for assignment
- User pages: enabling learners to create a personal webpage
- Classlist: providing information about learners, their activities, and contact information

2.1.1. SakaiTM

SakaiTM is a LMS that was built using a grant provided by the Mellon Foundation in 2004 when Stanford University, Michigan University, Indiana University, Massachusetts Institute of Technology University, and University of Berkeley began building a common Courseware Management System. In 2009 over 100 institutions were using the open source software of Sakai Collaboration and Learning EnvironmentTM (CLE), in production settings ranging from 200 to 200,000 users. Today this number has increased to over 350 educational organizations. SakaiTM offers two products. Sakai CLETM is "a full-featured system supporting technology-enabled teaching, learning, research and collaboration for education" and Sakai OAETM (Open Academic Environment) "is a scholarly space for research, teaching and learning" (Uys, 2011).

2.1.1. Canvas

Instructure Inc. was created to support the continued development of a learning management system (LMS) originally named Instructure. Once incorporated, the founders changed the name of the software to Canvas. The Utah-based company tested the LMS at several local schools including Utah State University and Brigham Young University before officially launching the system. As of 2020, it is used in approximately 4,000 institutions around the world (Bamforth and Emily, 20th December, 2021).

Canvas offers discussion boards for asynchronous discussions, chat rooms for live discussions, centralized email (Canvas Conversations), which enables instructors to effectively communicate with students and also allows for students to students interactions, and even a way to submit assignments and take exams. Canvas provides its users with a password-protected online classroom in which learners can use submit their work and communicate with their instructors and equally classmates (Synergy-learning, 2017).

2.1.2. Chamilo

Chamilo is free software, providing a platform for e-learning and collaboration, what is refered to as a Learning Management System. Fundamentally, an e-learning platform provides you (usually in a teaching position) with means to store and organize your educational materials online, and to share these with students to save them having to carry piles of books back and forth to and from school. But this is only the "tip of the iceberg" in terms of what you can achieve with an incredible LMS like Chamilo. It can offer huge range of features which are generally time-savings by taking over a range of repetitive administrative tasks, allowing you to focus on supporting students. It can

be used to create many types of teaching materials. More importantly, it can provide students with a range of motivational tools supporting effective independent study at their own pace, as well as a means to interact more completely with their teachers and fellow students. (Torreblanca et al, 2015)**.**

2.1.3. Atutor

ATutor was first released in late 2002. It came in response to two studies conducted by the developer in the years prior that looked at the accessibility of online learning systems to people with disabilities. Results of the studies showed none of the popular Learning Management Systems at the time even provided minimal conformance with accessibility guidelines. At the time a blind person for instance, could not participate fully in online courses (Sharon et al, 2004). Synergy-learning (2017) uncovered that Atutor excels for the good implementation and support of accessibility. However, it is shadowed by the fact that the lead developer jumps out of the project and now the development community seems not to be very active. This issue could be seen as an indicator of project discontinuing. Other things to highlight in this option is the teaching resources. Reports and analytics are no so advanced and pack less functionalities than the other alternatives. In general also aTutor is associated with the risk for the project of ending up with major restrictions for further developments synergy learning.

2.2. Usability Evaluation of Moodle

Moodle is an open source LMS that was initiated by Martin Dougiamas in 1999 as a PhD research project at Curtin University of Technology (Perth, Western Australia). Moodle is the abbreviation for Modular Object-Oriented Dynamic Learning Environment is a GPL/free open source e-learning software platform (Faruque, 2012). It is an Open source system which means that users would be allowed to run the software, study it, change it, and redistribute copies with or without changes free of charge. The first version of Moodle was released on August 20, 2002. In 2003, the Moodle.com company was launched and since that has sponsored Moodle development. In 2007, more than 20,000 users registered their active Moodle sites and this number in 2011 increased to over 70,000 sites from 223 countries (Moodle website, 2020). Moodle is considered as high value education community, mostly higher education and advance education. Moodle provides educators with the tools to manage and promote online learning. These tools include dozens of official Moodle could be activity modules such as forums, lessons, surveys, quizzes, and wiki as well as

modules and add-ons developed and shared by the Moodle community developers (Arsenovski etal, 2008).

On a specific note, Arsenovski et al (2008) investigated and evaluated the usability and instructor experience of the different standard modules of the Moodle. They found that instructors agreed, on average, that the Moodle is very useful at helping instructors in different activities (lessons, quizzes, HTML pages, quizzes, database, choices, announcements, assignments, workshops, discussion chat and forums, and glossary. In addition, Polizzi (2020) asserts that Moodle has been classified among the best Online Learning Management System available in this era, and that it is very easy to use for creating an online course. It can be used for providing a very interactive and composite form of a course that can be provided through the various online activities (i.e. through internet). Among the many activities and feature that Moodle and other LMSs offer are:

i) Reading assignments.   ii) Online live class.

iii) Papers and projects.   iv) Discussion of course concepts.
v) Forums.   vi) Tests.
vii) Keeping track of grades.   viii) Additional learning opportunities.

Perceptions of instructors about the ease, accessibility, and usefulness of LMSs and Moodle are critical factors in the success of the adoption and implementation of the blended learning system in institutions of learning. Ali and Mbabazi (2016) investigated the perception of the convenience and the usefulness of Moodle at Muni University for their learning activities. The outcome of the survey indicated that instructors' perception about the convenience of use has a direct impact on their perception about the usefulness of Moodle for their studies. The perception of students about the ease of use and the perception of convenience and usefulness had a statistically positive and significant association with the attitude toward the use of Moodle.

Furthermore, the perception of users depends on the ease of use of Moodle and other LMSs. However, the lack of training, adequate equipment, fast connection, and technical support hinder the satisfaction of the users of the system and their perception of the adoption of the LMS i.e Moodle. Ibid further mentions that the benefits of Moodle depend largely on the satisfaction of instructors in traditional and blended learning. Instructors' satisfaction about the LMSs depends on computer literacy levels (familiarity with computers), personal innovativeness, the quality of information offered, the quality of the system, the availability of training and technical support,

the support from the management, and the policy incentives given by institutions to instructors to continue adopting the and using LMSs for course administration and management.

Various studies have been conducted mainly focusing on the usability of LMSs and a good number of these indicated that user-based evaluation methods are mostly used in testing the usability of LMSs. For example, Thuseethan et al [10] used questionnaires to evaluate the usability of Moodle which was already being used in various universities at the time of their research from the perceptions of students. The outcome of this work indicated that the overall level of the effectiveness of learning management system constructed in students" perspective. The results revealed that most of the students liked the present system at the time of the study and found it very easy to access. However, the students aired out that it had some functional, design and technical problems in its usability. Further some of the major findings through this study were that; 1) It is useful that the system is trying to do much more than is required by user, 2) at that time it was hard to use some important functions like login and assignment submission, 3) Teachers should be given proper guidelines for using the system and 4) Maintainers were not efficient and not maintaining the components according to human computer interactions (HCI) standards. The researchers concluded that each and every revision of the LMS should be undergone or proofread by an expert or central authority to maintain the consistency.

Alternatively, Onacan M. and Erturk (2016) also investigated both students and teachers perceptions and use of Moodle. In their study they look at Usability testing as the evaluation of instructional tools/software for its ease of use to the frequent users within an instructional design practice. In other words, usability testing is the observation of typical users performing tasks with a product, conducted for the purpose of determining what changes need to be made to the content, presentation or user interface for that product as proposed by Alelaiwi and Hossain (2015). They add that Usability evaluation is considered one approach to assess the effectiveness of e-Learning systems. It is used to evaluate how well technology and tools are working for users. LMSs can benefit from usability research to evaluate the LMS ease of use and satisfaction of its users (Al-Khalifa, 2010). The results of this study showed that both the students and teachers had positive experiences with Moodle. For example, the results obtained showed that the majority of the users believed that Moodle was easy to use and it improved the communication between students and teachers. It also highlighted that despite the students being satisfied with Moodle, they provided suggestions to improve the quality of the learning materials and experience on Moodle including, among them the suggestion of using their own local language for Moodle's interface instead of the English language interface.

According to Denan et al (2020), the question that should be discussed and evaluated is not which LMS works best but rather how best to incorporate media and design attributes into the LMSs design, which will result in effective instruction for learning. Each e-learning platform consists of many attributes that could affect that platform's instructional value and it is more relevant to examine each attribute for its pedagogical possibilities relative to the needs of learners than to generalize the impact of the platform as a whole. AlQudah (2014) adds further by suggesting a system of identifying categories of attributes embedded in each delivery system that can be used to support learning in different ways. Many studies have tried to control for this by delivering the same strategy by the different media being compared. By doing so, they removed the very differences that make one LMS a better choice than another in a given learning context.

Adhikari et al (2015) assert that the use of the open alternative educational resources (OAERs) has become frequent among instructors to enhance the flexibility of the class material. The OAERs are means to make the content and material taught in class more flexible. However, Ibid adds and says continuation of the use of OAERs also depends on the technological platform adopted by an institution. The usability allows institutions and educational professionals to assess the usefulness and easiness of the technological platform in serving learners. The affordances of LMSs do not stand alone from other considerations such as the social and cultural settings in which the learning is situated. LMSs strongly under-line the importance of sound planning, imagination and creativity on the part of the teachers and course managers in designing meaningful learning experiences with these technologies.

Despite the usefulness of the LMSs for students, researchers have found that the current LMSs used in developing countries, such as Sri Lanka, still have limitations in uploading (Achchutanhan etal,). Ibid also stated that Sri Lankan teachers reported a lack of clear user guidelines and suggested that every update made to Moodle be reviewed by an expert before it is implemented. The good function of Moodle and LMSs, in general, is crucial for the success of traditional learning as well as contemporaneous forms of learning such as the blended learning, which has gained ground among education professionals both in developed and developing countries. However, the survival of Moodle and other LMSs depends on the perceptions of instructors using Moodle to upload the learning material for their students. Among 258 surveyed teachers in Tanzanian institutions, 53% of them had positive attitudes toward Moodle and LMSs in contrast to 47% who

showed negative attitudes. The exposure to the computer has a statistically significant correlation with the attitude of Tanzanian high education teachers toward LMSs (Kisanga, 2015).

Many more studies have been done concerning the subject matter, however, last for this discussion, both the heuristic evaluation method and user testing methods were employed to evaluate the usability of Moodle from the perspectives of both students and teachers. The results showed that the students and teachers were more familiar with using the user interface in their own local language (Macedonian) instead of the English language interface. This is similar to the two studies discussed above. Also, the results showed that Moodle had usability problems regarding the assignment submission and online chat features, (Kakasevski et al, 2008).

CHAPTER 3
METHODOLOGY
3.1.   INTRODUCTION

This chapter gives an outline of research methods that were followed in the study. It provides information on the participants, that is, the criteria for inclusion in the study, who the participants were and how they were sampled. It further describes the research design that was chosen for the purpose of this study and the reasons for this choice. The instruments that were used for data collection are also described and the procedures that were followed to carry out this study are included.

3.2.   RESEARCH DESIGN

The mixed methods research approach will be used. The contemporary which is the combination of traditional quantitative and qualitative approaches. The existence of the mixed methods approach stemmed from its potential to help researchers view social relations and their intricacies clearer by fusing together the quantitative and qualitative methods of research while recognizing the limitations of both at the same time (Brannen and Gemma, 2012). According to Haq (2014) this approach provides triangulation which provides researchers with the opportunity to present multiple findings about a single phenomenon by deploying various elements of quantitative and qualitative approaches in one research. Walker (2006) asserts that this design has been chosen because this research involves experiences, and understanding these is more important than looking for an outcome.

3.3. SAMPLING

Purposive sampling is a method of sample selection that focuses on particular characteristics of the population that are of interest and will enable the researcher to fully answer the research questions [19]. Probability and Purposive sampling was used in this study. The University of Zambia main campus constitute over 15 000 students. From this population a sample 100 students under the department of library and information science were selected purposefully to take part in this research to which a total of 38 respondents took part. Students from the LIS determent were selected because of the convenience of accessing them. The department all has got full representation of students from all the undergraduate study years.

3.4. DATA COLLECTION

3.4.1. Questionnaire

Data was collected using a System usability Scale (SUS) questionnaire which was administered online to the participants via Google forms. The SUS was used because it is vital tool for scenarios of evaluation of usability and user experience. The format of the questionnaire supports the immediate user response to express feelings, impressions, and attitudes that arise when they use a product. In addition, the questionnaire can be applied as an online form and a user in a few minutes can fill it out. The questionnaire allowed each participants to quickly evaluate their Moodle usage which served as important data for this research. The scale and Questions of the questionnaire are developed to cover a comprehensive impression of system usability in relation to user experience. The questionnaire consisted of 15 questions with a 5 point likert scale. See Appendix C.

3.4.2. Document analysis and system analysis

After selecting the systems to be used in this research according and arriving at Moodle, Sekai, Canvas, Chamilo and Atutor according to Appendix D. Document analysis was carried out in order to have a comprehensive list of features that each LMS offers from the systems documentations that outlines the systems features and how they work. Furthermore to have a complete and supported feature set the system was analyzed using the online demo version that enables discovery of the systems overall teaching and learning features.

3.5.   PROCEDURE

3.5.1. Discovery and comparison of affordances available on popular LMSs

Free and open source LMSs have a diverse of features, targeting a range of users. Below are some key teaching and learning features that must be available on a popular FOS LMS in order to consider it while selecting an LMS to implement. These were compiled by a group of five (5) fourth year students under the department of library and information science and majoring in Information and communication Technologies (ICTs), who are herein regarded as experts due to their experience interacting with an array of software since their first year at the university and with the help of research on what features are generally common on popular LMSs. The feature matrix bellow contains a categorized list of features that were used and ticked as they carried out document analysis and also interacted with the demo versions of the systems in order to get to know the associated teaching and learning features available on each LMS.

ICT 4014 group14: Learning management system evaluation feature matrix

TEACHING AND LEARNING FEATURES

1. Communication Tools
• Discussion forums…………..……………….... ☐
• File exchange/ Internal email………………..... ☐
• Online journal/notes…………..……………..... ☐
• Real time chat………..……………..………... ☐
• Video services…………….………………… ☐

2. *Productivity* **Tools**
• Book marks……………..…………………….
• Student/Teacher orientation/help…………….. ☐
• Searching within course....………………….... ☐
• Calendar/ progress review... …………………. ☐
☐

3. Student involvement
• Group work………..…………….……………... ☐

4. Course Delivery Tools
• Course management…………..……………… ☐
• Online grading tools…………..……………… ☐
• Student tracking……………..……………… ☐
• Automated testing and scoring……………… ☐
• Course templates…………..………………… ☐
• Customized look and feel………..…………… ☐
  Instructional design tools………..…………….. ☐

Table1. Feature matrix

3.5.2. Student's evaluation of Moodle LMS at the university 0f Zambia.

The experiment required that the participants had access to Laptops and/or phones which they used in order to complete the project experiment tasks. The participants required internet connection in order to complete the given tasks on the systems.

Moodle LMS Systems configurations;

The Moodle LMS was installed and configured on a cloud based platform by the project team and made available to the research participants via the link: https://drive.google.com/file/d/10vhf10cFZDKOIcqOwKV4H-tRwVL48Nr0/view?usp=sharing which lead the participants to the guidelines document that in on Appendix B which they had to be download and followed through to the end to complete the tasks.

Participant's activity;

The participants constituted a mixture of first, second, third and fourth year students under the LIS department at the University of Zambia. These were asked to aid participation by accessing and attending to the activities setup on Moodle. They were invited to participate in the experiment by formal emails and messages that lead them to the link stated above. The guidelines document guided each participant through the tasks below;

Activity 1:

1. Task 1: access and read announcement
2. Task 2: access and download course resources
3. Task 3: attempt and complete short quiz
4. Fill out the usability Questionnaire
   Activity 2:

Fill out the system usability questionnaire for Moodle LMS at link:

https://forms.gle/4ahgCQsU4dcf1sqP8

3.6. DATA ANALYSIS

All the collected data were downloaded from Google forms in the form of excel worksheet and were then exported to and analyzed using Statistical Package for the Social Sciences (SPSS). First, the data were checked for completeness. Then, the data were analyzed during descriptive statistics. Due to the nature of our research questions and the type of data, most of the data analysis for this study occurred at this level.

CHAPTER 4
RESULTS

This chapter presents the results according to the data that was gathered following the procedure in chapter 3.5 above.

4.1. Teaching and learning features available on FOS LMSs

After conducting document analysis and system analysis to discover the feature offerings on the LMSs as highlighted in chapter 3.5.1 above and comparing the features among the five (5) LMSs the following results are presented;

FEATURE	ATUTOR	CHAMILO	CANVAS	MOODLE	SAKAI
1. Discussion forum	✓	✓	✓	✓	✓
2. File exchange	✓	✓	✓	✓	✓
3. Online journals		✓		✓	
4. Real time chat	✓	✓	✓	✓	✓
5. Video conferencing			✓		
6. Bookmarks	✓			✓	
7. **Announcements**	✓	✓	✓	✓	✓
8. Searching within course	✓		✓		
9. Calendar/progress review	✓	✓	✓	✓	✓
10. Student group work	✓		✓	✓	✓
11. Student assessment	✓	✓	✓	✓	✓
12. Course management	✓	✓	✓	✓	
13. Online grading tools	✓	✓	✓	✓	✓

Feature					
14. Student tracking	✓	✓	✓	✓	
15. Automated testing and scoring	✓	✓	✓	✓	✓
16. Course templates			✓		✓
17. Customizable look and feel	✓	✓		✓	✓
18. Instructional design tools	✓	✓		✓	

Table2: **LMS Teaching and Leaning Feature Matrix**

From table 2 above it is seen that;

Online journals: Moodle and Chamilo do offer online journals while canvas, Sakai and Atutor do not.

Video conferencing: canvas is the only platform among the five LMSs which comes with video conferencing features.   However, the other four LMSs make use of other applications and extensions for virtual classrooms such as, Zoom, Google meet, BigBlueButton etc.

Bookmarks: Atutor and Moodle come with bookmarking capabilities which is not offered on the other three (3) system.

Searching within course: to quickly locate resources on the course page Atutor and canvas offer course search features which are not available on the other LMSs

Student's group work: all except chamilo have options for students group work

Course template: canvas and Sakai offer course templates for course building. A feature which is not present on Moodle, Atutor and chamilo

4.1.1. Features available for teachers

Features	ATUTOR	CHAMILO	CANVAS	MOODLE	SAKAI
Online grading tools	✓	✓	✓	✓	✓
Student tracking	✓	✓	✓	✓	
Automated testing and scoring	✓	✓	✓	✓	✓
Customized look and feel	✓	✓		✓	✓

Student assessment	✓	✓	✓	✓	✓
Real time chat	✓	✓	✓	✓	✓
Instructional design tools	✓	✓		✓	
Discussion forum	✓	✓	✓	✓	✓
Announcements	✓	✓	✓	✓	✓
Course templates			✓		✓
Video conferencing			✓		

Table3: **LMS teaching features**

Student tracking: student tracking systems allow tracking of students' progress using analytics and reporting tools. This is available on all except Sakai.

Customized look and feel: the user interface on each of the LMSs is highly customizable. However, on canvas customization is rigid, you can only use the default look and theme.

Instructional design tools: Instructional design software is any software used by instructional designers to create eLearning content. This content may come in various formats, from texts and presentations to podcasts, videos, and many others. Chamilo Atutor and Moodle support the use of IDT while canvas and Sakai do not.

Course templates: canvas comes imbeded with course templates while these other LMS require the use of course template plugins such as KickStart for Moodle.

Video conferencing: all the LMSs with an exception of canvas do not offer video conferencing features. Video conferencing on these LMSs is achieved using third party software such as BigBlueButton and Zoom

4.1.2. Features available for students

Feature	ATUTOR	CHAMILO	CANVAS	MOODLE	SAKAI
File exchange	✓	✓	✓	✓	✓
Course calendar	✓	✓	✓	✓	✓
Student group work	✓		✓	✓	✓
Real time chat	✓	✓	✓	✓	✓

Discussion forum	✓	✓	✓	✓	✓
Bookmarks	✓			✓	
Online journals		✓		✓	
Search within course	✓		✓		

Table4. **LMS student's features**

Student group work: all have features that allow students to carry out group work with an exception of chamilo which has no such provisions. On chamilo students can make use of other collaboration platforms for group work.

Bookmarks: Atutor and Moodle are capable of bookmarking which allows a Learner to return to the point they left off when launching. This feature is not offered on the other LMSs.

Online journals: Moodle and Chamilo do offer online journals while canvas, Sakai and Atutor do not.

Searching within course: to quickly locate resources on the course page Atutor and canvas offer course search features which are not available on the other LMSs

### 4.1.3. Undergraduates evaluation of Moodle at the UNZA
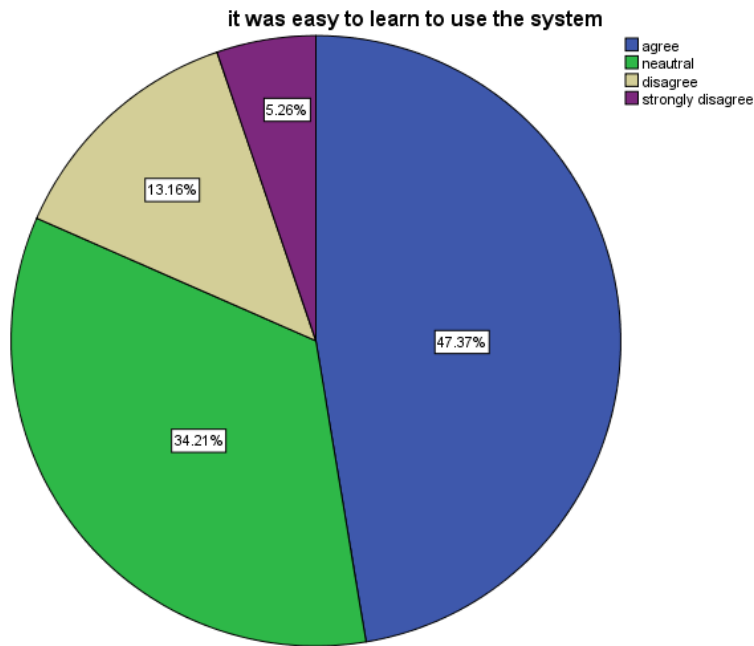
Figure 1: Is was easy to use the system

From the pie chart on figure 1 above it is shown that a considerable number of students felt it was easy to learn the system based on the activities that were set for them. They represent a total of 47% of the respondents. 13.16% of the respondent disagreed hence saying the system is not easy to learn. 5.26 percent strongly with the assentation that Moodle is easy to use. 34.21% gave a neutral response.

support information such as (online help, on-screen messages, and other documentation is provided by the system)

Legend:
- strongly agree
- agree
- neautral
- disgree
- strongly disagree

15.79%
26.32%
28.95%
18.42%
10.53%
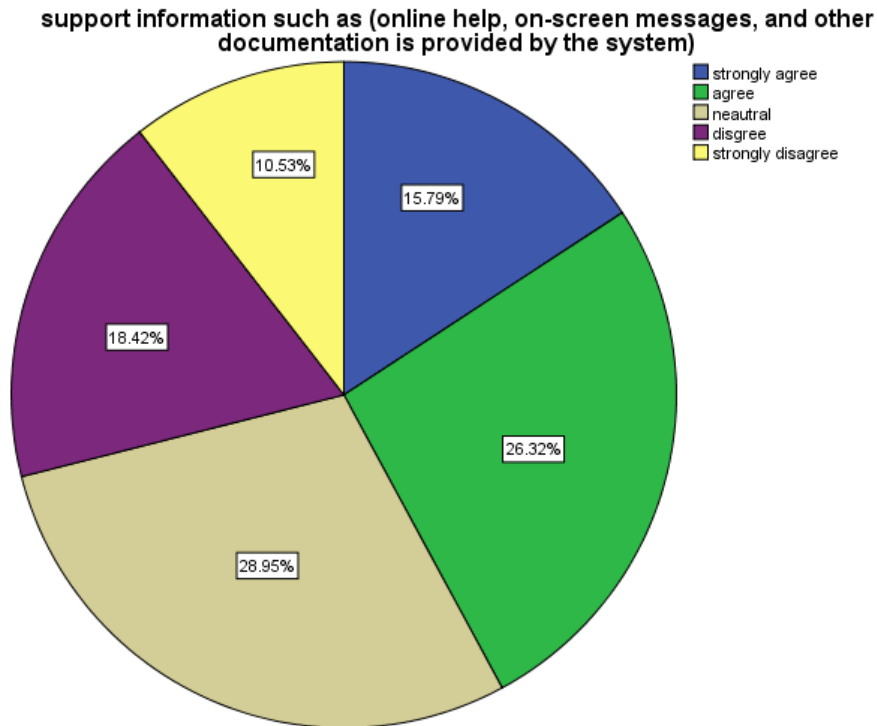
Figure 2: support information such as online help, on-screen massages, and other documentation is provided on the system.

The pie chat on figure 2 gives the representation of the responses given on the SUS question asking if support information such as online help, on-screen massages, and other documentation is provided on the Moodle system. From the above, 26.32% agree, 18.42% disagree, 15.79% strongly agree, 10.53% strongly disagree and 28.95% responded neutral to this question.

CHAPTER 5

DISCUSSIONS OF FINDINGS

CHAPTER 6

6.1. STUDY LIMITATIONS

The limitation was not a success due to the small number of respondents that took part in the research. It is was a challenge to get the participants to take part in the study as most of them were having exams. The experiment was conducted at the time when first year students were not in campus hence the ado to access them. It is therefore difficult to generalize and effectively interpret the data gathered seeing that it is unbalanced.

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APPENDICES

APPENDIX A

Experiment Protocol: University of Zambia free and open source learning management evaluation

1. Introduction

This experiment is part of an undergraduate final year capstone project which is being conducted by fourth year students under the department of library and information science at the University of Zambia, which involves interacting with free and open source learning management systems software. You will be required to perform some tasks two out of the five LMSs selected for this project namely Moodle, chamilo, sakai, canvas and Atutor. After completion of all the tasks, you will be required to fill out two questionnaires to share your experiences using the two LMSs. The online questionnaire consists of non-open ended questions. You are expected to rate your experiences using a 1—5 likert scale.

2. Consent Form and requirements

A consent form will be made available to each participant that they each sign before participating in this experiment so that they can confirm that the requirements have been made known to them and instructions given prior commencement.

This Experiment will require that the participants have access to **Laptops** and/or **phones** which will be used in order to complete the project experiment tasks given on page 2 of this document. The participants may require the internet in order to complete the given tasks on the systems.

3. LMS Systems configurations and Experimental Groups

3.1 configurations

All the LMSes mentioned in section 1 above will be downloaded from their respective sites and installed on a remote server which will enable them to be set up and later accessed by the study participants. Once the LMS have been installed, each of these will be configured, setting up the environment and making them ready for group 1 of the participants to build course modules on each of the 5 LMSs; Atutor, Sakai, Chamilo, Canvas and Moodle.

3.1 Group 1

Experimental group 1 constitutes 4th year students under the department of Library and Information science at the University of Zambia. This group of students has been selected mainly, firstly, because of the convenience to accessing them and secondly because they have been interacting with computers and different types of software systems from first year to present date as a result of the nature of their programs. It is also assumed because of the earlier stated

reason that they can easily figure out the various features of the LMSs which will be prescribed to them.

3.1.1 Activity 1: determine the features available on popular LMSes

1. Task 1: login to the LMS using given login details
2. Task 2: poke around the user interface of the LMS to discover the teaching and learning features available on LMS
3. Task 3 : tick on the checklist provided containing a summary of all the possible features available on most of the LMSs

3.2 Group 2

Group 2 constitutes a mixture of first, second, third and fourth year students under the LIS department at the University of Zambia. These will be asked to aid participation by accessing and attending to the activities setup on Moodle.

1.2.1.   Activity 1:

Course activity engagement

5. Task 1: access and read announcement
6. Task 2: access and download course resources
7. Task 3: attempt and complete short quiz
8. Fill out the usability Questionnaire

1.2.2.   Activity 2:

Fill out the system usability questionnaire for Moodle LMS at link:
https://forms.gle/4ahgCQsU4dcf1sqP8

4. Documentation

Please make sure that:
- You have signed the consent form
- You have completely filled out the questionnaire

5. Debriefing

Thank you very much for your participation in this study. Your data responses have been saved and submitted successfully.

If you wish to acquire further information about this study, please contact the project coordinator from whom you acquired your access links.

APPENDIX B

Guidelines to Moodle activities

You are required to carefully follow the guidelines below in order to successfully participate in this experiment.

Step 1:
Download this document to your device and open it to easily follow the steps.

Step 2:
Click on this link:https://moodle-62287-0.cloudclusters.net/ to access LMS-A

Step 3:
Once you are on LMS-A navigate to the login link on the top right corner and login using any of the details the details below and click login;

Username: 2017012999@student.unza.zm
Password: @Zx010101

Username: 2017012992@student.unza.zm
Password: @Zx010101

Username: 2017003403@student.unza.zm
Password: @Zx010101
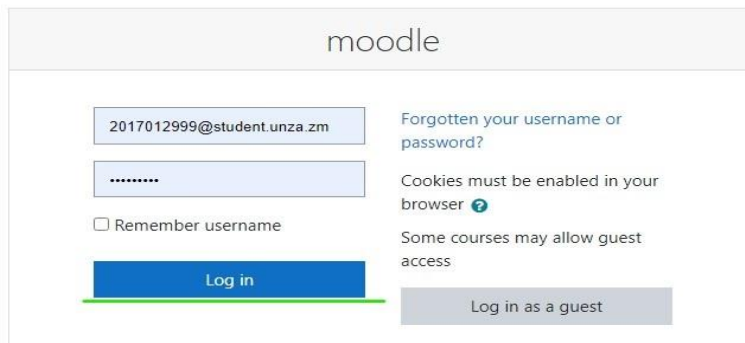
Username: 2017012972@student.unza.zm
Password: @Zx010101

Username: 2017009170@student.unza.zm
Password: @Zx010101

Step 4:

After login you will be presented with the courses page then select the course named "fundamentals of information and communication technologies (ICT 9010)". Navigate and download the 2 course resources then click on the activity named **Quiz 1.**

Step 5:

After clicking Quiz 1 on step 4 this page will be presented. Click on **Attempt** or **Re-attempt Quiz** button**.**
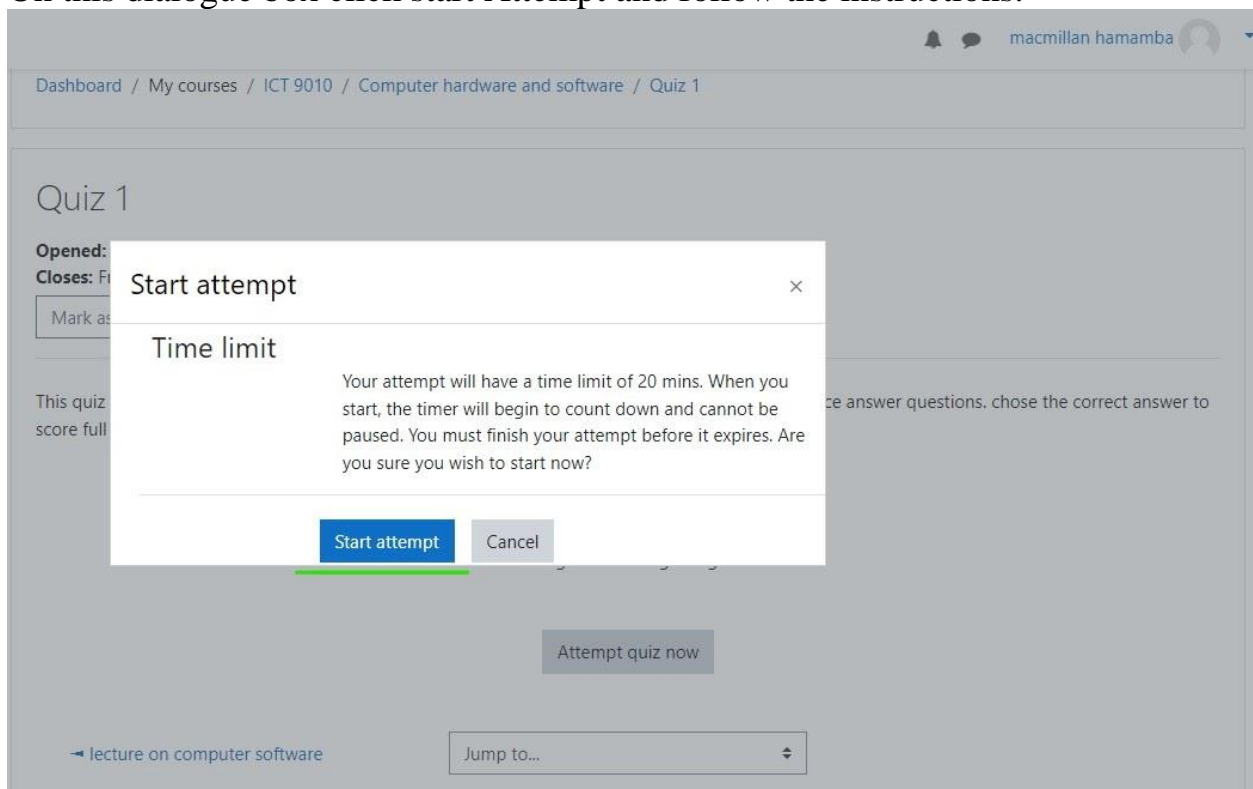
Step 6:
On this dialogue box click start Attempt and follow the instructions.

Step 7:
When you are finished answering the Quiz click on the finish attempt button to save your responses.

Step 8:

After step 7 click on submit all and the finish button save your Quiz responses.

Step 9:

Thank you for your response in step 8. The final step requires you to fill our the system usability questionnaire for LMS-A which is at this link: https://forms.gle/peBGajND6hTikujUA.

Thank you for your participation!

APPENDIX C

Project team_14: Learning Management Usability Evaluation Questionnaire for Moodle LMS

This questionnaire is aimed at gathering data for the a final year capstone project being conducted by fourth year students under the department of library and information science at the university of Zambia which is titled "Determine the affordances, usefulness and usability of popular free and open source (FOS) learning management systems (LMSs)". This document will help in answering the second objective of the study which is to determine the usefulness and usability of popular FOS LMSs. You are presented with this Questionnaire after interacting with learning management system A (Moodle).

#Briefing:
LMS. You are required to answer all questions.
#Instructions:

Questions are scaled from 1 to 5 where 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree. Simply select a number on the scale that applies to your response.
*   Required

1.   Email *

        _____

2.   Gender *

        Mark only one oval.
        ◯ Female
        ◯ Male

3.   How old are you? *
        Mark one oval only
        ◯   18-25
        ◯   25-30

3.   Year of study *
        Mark only one oval.

( ) First year
( ) Second year
( ) Third year
( ) Fourth year

4.   1. Overall, I am satisfied with how easy it is to use this system. 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

5.   It is simple to use this system?
1= strongly Agree, 2=agree, 3= neutral, 4= disagree   and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

6.   I am able to complete my work quickly using this system.
 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

7.   I feel comfortable using this system.
1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

9. It was easy to learn to use the system.
1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

10 I believe I became productive quickly using this system.
        1= strongly Agree, 2=agree,   3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

11. The information provided with the system is effective in helping me complete my work. 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

12. The organization of information on the system screen is clear. 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

13. The interface of this system is pleasant. 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

14. I like using the interface of this system. 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

15. This system has all the functions and capabilities I expect it to have. 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

16. Overall, I am satisfied with this system. 1= strongly Agree, 2=agree, 3= neutral, 4= disagree and 5= strongly disagree *

Mark only one oval.

	1	2	3	4	5
	◯	◯	◯	◯	◯

APPENDIX D

Project_team_13 Learning management systems selection

It should be noted that there are many free and open source learning management systems (LMSes) available out there. The scope of this project cannot in any way manage to cover all of them, it is due to this reason that a list of some popular free and open source LMSs was made as follows;

- Moodle
- Google classroom
- Black board learn
- Sakai
- FormaLMS
- Canvas
- Eliademy
- Atutor
- Coggno
- Chamilo
- OpenEdx
- Talent LMS
- loudCloud
- Claroline
- EdApp
- CourseSites

From the above, seven (7) were chosen through the following criteria;

i.   LMS is installable locally (self-hosted)
ii.   LMS if freely available for download and installation
iii.   LMS is popular in the category of FOSS LMSes.

After filtering we settled to use the following in this research;

1. Moodle
2. Sekai
3. Canvas
4. Chamilo
5. Atutor