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IMPACT OF MOODLE AS AN OPEN SOURCE E-LEARNING PLATFORM ON STUDENTS' PERFORMANCE: A CASE STUDY OF JOMO KENYATTA UNIVERSITY OF SCIENCE AND TECHNOLOGY (JKUAT)

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Abstract: **Integrating ICT in education and the design of instructional materials have faced a great challenge given the emergence of several e-learning platforms used by the learners in several academic institutions of higher learning. Some scholars have pointed out that e-learning requires highly self-regulated, independent and dedicated student for high performance to be achieved. Moodle is an example of the open source e-learning software that is most widely used in the dissemination of learning processes. The purpose of this study is to analyze how introduction of Moodle as part of the teaching process is related with students' performance based on the socio-demographic variables, amount of time taken online and offline, User Interface Design and prior computer knowledge and skills. "Descriptive survey design is to be used for this study as it provides qualitative and quantitative description of sample of population studied. The study aims at sampling 100 respondents from the various departments in SODEL and face-to-face class-room students for the period of 2018 to 2019.Primary data was obtained by developing and administering questionnaires to the respondents. The questionnaires were contain both open-ended and contingency questions. The data was analyzed using quantitative and qualitative methods. The data collected through questionnaire was coded, summarized, and edited for possible errors. Descriptive statistics was used to compute the data collected from the field. Inferential statistics such as chi- square test will be used to test hypothesis at 0.5 level of significant. The data collected was processed using Statistical Package for Social Sciences (SPSS) version 20.The result of the analyses was used to document the findings of the study." The study shown a comparative performance analysising those students that are using and not using Moodle and the main problems that affect performance. The results was an important principal for the management of Universities when further investigating on how to improve students' performance on different levels while employing modern ICT solutions in the teaching process**

Keywords: **Moodle Open-Source E-learning Platform, computer skills, -demographic factors, academic performance.**

1. INTRODUCTION

According to Chimombo, (2005) education plays a significant role in an aim to achieve sustainable development. Due to e-learning's great support to the factors which support lifelong studying, it has become important to educational systems and the society. Therefore, demand in various fields and institutions is increased. Internationally, education programs cope with increased demand by implementing technological methods in learning and teaching practices according to

Lesjak, (2009). Learning and teaching have been revolutionized by technological advances (Aristovnik et al, 2016). Some new developments in technology have transformed the teaching and learning practices. Furthermore, these developments include; Moodle e-learning, the desire to acquire more cost-effective learning and teaching methods, the need for urgent delivery of information and the rapid expiration of training and knowledge.

Developing and developed countries have different educational settings which include the level of education which is relatively low in developing countries and the small attendance of schools in rural areas due to high costs and far distances (Boyd, 2004). Usage of the Moodle instruction for dissemination and material preparation is more effective compared to the ancient classroom instruction. One of the main advantage for using Moodle e-learning is reducing the distance therefore eliminating the travelling programs and the costs involved given that the system is properly designed for easy access by the learner. Moodle e-learning is more flexible and can be accessed anywhere and anytime. However, the system has to be designed in a way that it engages the student and promotes learning.

Moodle at JKUAT:

According to Kasse, (2013), "originally Moodle an acronym for Modular object –oriented Dynamic Learning Environment, which helps education theorists and programmers. As such, this applies to the way the teacher or student approaches studying or teaching online. Moodle main philosophy is to support a style of learning called Social Constructionist Pedagogy. This style is what is also called interactive. This is because this philosophy believes that people learn best when they interact with learning material, construct new material for others and interact with other students about material." JKUAT uses Moodle in the dissemination of teaching and learning. The tutors are able to prepare their lessons and teaching materials from this interface and also allocate the possibilities of handing in the assignments by the leaners.

Electronic Learning (e-learning):

(Wild et al. 2002) and(Fry, 2000) have described E-learning as the deliverance of education and training through distribution technologies and networked interactivity while others see it as simply communication and learning exercises across networks and computers or in other words the use of electronic sources. Khan, (2005) elaborates, "E-learning has been explained in various ways as learning using a number of different technologies and methods for delivery e.g. Computer Based Training (CBT), Internet-based training (IBT), Web-based instruction (WBI), advanced distributed learning(ADL), distributed learning (DL), distance learning, online learning (OL), mobile learning (or m-learning) or remote learning and learning management systems (LMS)."

Open Source:

The term Open Source is often used in describing methodologies for software development which dependent on the contribution that their developers who are geographically dispersed via the internet. According to Gacek et al., (2013) one other critical criteria for open source projects is the source code availability. Failure to have this source could make evolution or development of the software almost impossible considering the difficulty involved.

Statement of the problem:

Integrating ICT in education and the design of instructional materials have faced a great challenge given the development of several e-learning platforms used by the learners in several academic institutions of higher learning. Moodle is an e-learning platforms that has been used in the dissemination of teaching and learning activities. Onwuagboke et al, 2015 states that many nations do not seriously recognize the role of ICT in the advancement of knowledge at the tertiary level of education and also at the higher institutions of learning. They also specified that there is need to create the ICT schools which will automatically increase the learning gains of the learners.

In the past decades, the struggle for seeking higher education to those in employment had been a great challenge since they have to spend the free time they have over the weekends, evening and holidays to physically go to the respective universities and learn. Moodle has offered a great deal of help to curb such issues by offering e-learning option for the course development and dissemination through the use of internet. From the reviewed literature, most of the studies have looked at the impact of e-learning in general on student motivation and performance. "Several studies have also been carried out on academic performance especially on traditional and blended learning approaches' students, but not much on e-learning students using Moodle within the Kenyan educational system. From the literatures reviewed, few studies have

taken note on the contributions of e-learners' socio-demographic data, time spent online and offline and prior computer skills as variables contributing to their performance (Aristovnik et al., 2016).

The gap in these several e-learning related studiesreviewed is how Moodle in itself as an open source system have influenced student performancebased on the socio-demographic factors in comparison to the influence of the traditional methods and blended methods of Learning. The purpose of this research is therefore to analyze how the introduction of the Moodle e-learning system as part of the teaching process has improved students' performance at the Jomo Kenyatta University of Agriculture and Technology (JKUAT) School of Open, Distance and E-Learning (SODEL)". This study therefore intends to fill the gap in the other studies by carrying out the impact of Moodle as an e-learning tool on students' performance based on the online experience and socio-demographic factors such as gender, students' special needs.

General Objective:

The general objective of this study was to establish the impact of Moodle Open-Source E-learning Platform on academic performance.

Specific Objectives of the Study:

i. To determine problems students experience while using the Moodle system and how they affect the academic performance of leaners

ii. To determine how prior computer skills and knowledge affects the learners' academic performance while using Moodle.

iii. To determine the roles played by Moodle e-learning components/features in enhancing the student academic performance.

iv. To determine how socio-demographic factors of learners affects their academic achievement of Moodle users

Research Questions:

The study was guided by the following research questions:

I . What problems do leaners using Moodle system experience and how do they affect academic performance?

ii. To what extent does prior computer knowledge and skills affect academic performance of Moodle users?

iii. What are the usability issues with Moodle features that affects its operability of hence affecting the user's performance?

iv. To what extent does Socio-Demographic Characteristics of Moodle users affect their academic achievement?

Basic assumptions of the study:

The basic assumptions that were used by the researcher to guide the research study were formulated as follows:

i. The respondents were available and would participate in the study by way of giving their honest opinion on the questions asked.

ii. It was also assumed that the respondents gave correct information needed by the researcher.

2. LITERATURE REVIEW

Introduction:

A deeper view to the present state of teaching and technology can be discovered through offering an extensive literature review to the Moodle-based instruction, comparative studies and learning methodologies. Alhothli, (2015) explained that these studies help the researcher to understand the areas which need more investigation and evidence which can be included in the study. There are many studies which focused on e-learning and how it affected the performance of students since it was been used frequently in the past decades for teaching and learning as well. Moodle, which is a significant tool in the delivery of instruction has been used in many learning areas based on the opinion of Saba (2012). Moreover, the results produced by Moodle are better or equal to traditional classroom learning system. Nevertheless, this was one of the main reasons for introducing Information Communication Technology (ICT) in the study process.

Despite the many advantages associated with this study process, there are various limitations which lower the degree of positive impacts for the modern ICT tools on the performances of students. The usage of Moodle in the e-learning system guarantees that there are other factors which are not related to e-learning and they positively or negatively influence the student's performance. Although ICT is an important platform for e-learning, Lesjak, (2009) explains that it does not have any statistical importance on the effectiveness of the system. Similar to this discovery, Russell (2001) depicted that there are no statistical differences between online and classical learning.

2.1 Problems students experience while using the Moodle system and how they affect their performance:

A study conducted in Zimbabwe showed that the majority of the lecturers (97.5%) facilitating open, distance and e-learning (ODeL) had no experience in distance education (Mpofu et al., 2012). Effective use of distance learning technologies demands that teaching staff be properly trained in using distance education as a mode of delivery. To date, few African scholars are familiar with teaching in an online environment. This situation poses a major challenge in introducing distance education on the continent.

According to a study by Welzer (2010) they analysed the student usage of Moodle's communication capabilities. Unfortunately, it was noticeable that students are not as prepared and eager as their lecturers to use communication capabilities in Moodle, particularly advanced web 2.0 communication elements like forums, chats, blogs, and wikis as the data below indicates

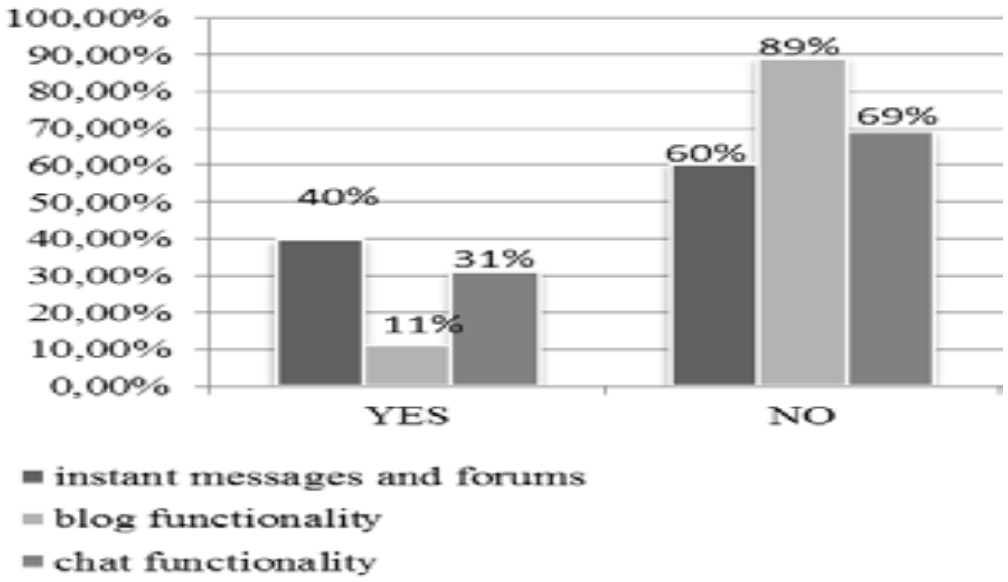

Figure 2.1: Usage of Moodle's communication capabilities

Source: Welzer(2010)

Further analysis by Welzer 2010 indicated that only 39.71% of students use forums and instant messages regularly, mainly to track current course activities or to ask questions about assignments and subjects in general. Blogs are used by 11.03% and chat by 30.88% of students. The majority of students in their analysis do not use blog functionality because they do not need blog functionality, they do not use blogs at all and they do not know that this functionality even exists. Similar results were acquired for the chat capabilities in Moodle as 70% of students do not use it and because they use e-mails or they do not need this function. Additionally, most students (60%) do not use instant messaging and forums, and 40% of those who use it. Most of the students say they still prefer personal communication with professors and assistants or use e-mail communication instead. According to a study done in the University of Dar es Salaam by Mtebe et al. (2013), they listed the following as the main challenges. ***Out-dated Learning Resources*** The findings indicated that, most of learning resources posted in Moodle system were outdated. This implies that the instructors were not updating learning resources once they post them in the system. When respondents were asked to rate if learning resources were regularly updated and references were current and relevant, over 70% of respondents strongly disagreed.

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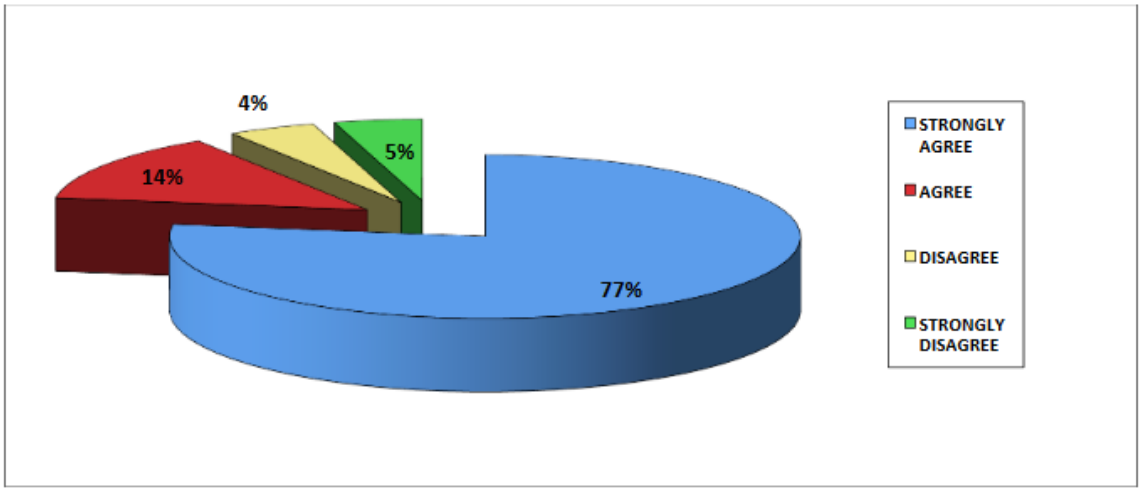

Figure 2.2: Course content are Organized logically throughout the Course

Source: Author(2013)

Internet Connectivity and Computer Access The majority of respondents (72.7%) had access to reliable Internet connection as well as access to computers as shown in Figure . However, some courses which were integrated with animations, and video clips could not play well due to slow internet speeds.

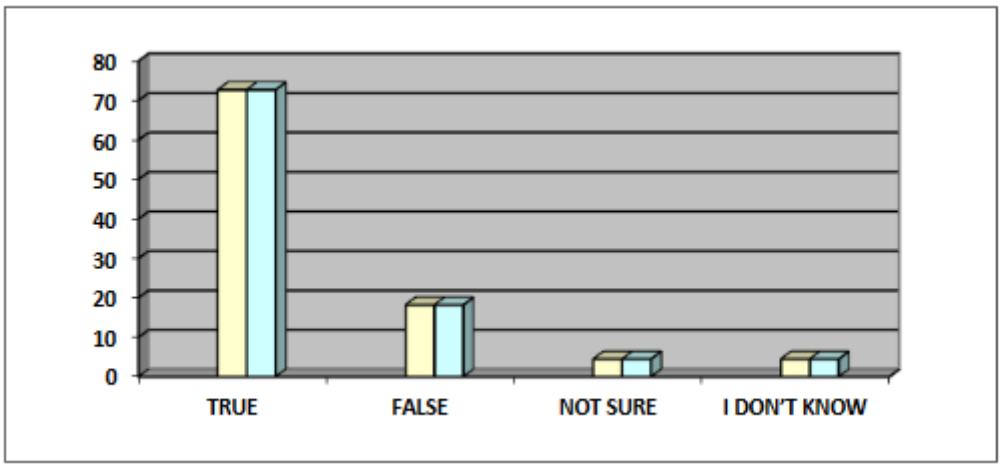

Figure 2.3: I have convenient access to computer/Internet

Source: Mtebe et al.(2013)

2.2 The Role of Prior Computer Knowledge on Learners' Performance in Moodle E-learning Environment

Based on individuals educational background, some learners are usually equipped than others in the use of online technologies that enables their progress in academic matters.

Levin & Arafeh (2012) "shed light on the differences between students who are highly gifted in the internet usage and those who have had little experience with online learning tools. Dewar &Whittington (2000) concluded that adult learners' learning styles (as indicated by Myers-Briggs personality types) could predict the various patterns of their participation in e-learning systems and courses.

According to research done by Alhothli (2015). In his study on how the prior computer skills and knowledge affect performance, the majority of the participants, as illustrated in the figure below, had obtained skills to use the system in the process, while only 2.8% did not have any skills to use the system.

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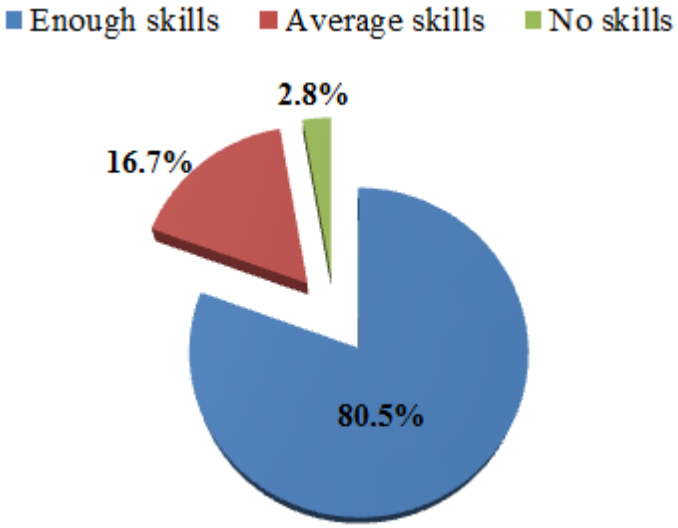

Figure 2.4: Skills to effectively use Moodle LMS for education

Source: (ALhothli, 2015)

It was clear, therefore, that after using the system in accessing courseware, students acquired knowledge and skills to do other activities related to management of courses and course assessment. Students with skills to use the system could download course materials, upload activities (assignments), and engage in online discussions through forums and in doing activities such as online quizzes. It is evident that the response of the students in using the system was positive.

According to Looker & Thiessen (2002), individual; *preparedness* seems to be a crucial factor in evaluating the success of e-learning applications like Moodle in education. In their paper, they noted that digital divide for Canadian youth, elaborated that; access to, and experience with, computer technology determines; *computer competency*", and that this competency is generally associated with urban residents of higher economic status.

In relation to this study, it is therefore important to point out that certain e-learning method or style using Moodle may be the student's key strong point in relation to the technology in use. Several research studies have shown that past computer knowledge and skills is a strong indicator of attitudes towards, computers, it applications, online platforms (software), intranet and the internet (Atkinson, 1997). As a result of this, the student's learning style may change and improve as familiarity with the Moodle e-learning platform increases.

Figure below is a presentation on the findings by Odhiambo, (2010) on whether the participants in this study had difficulty in using computers.

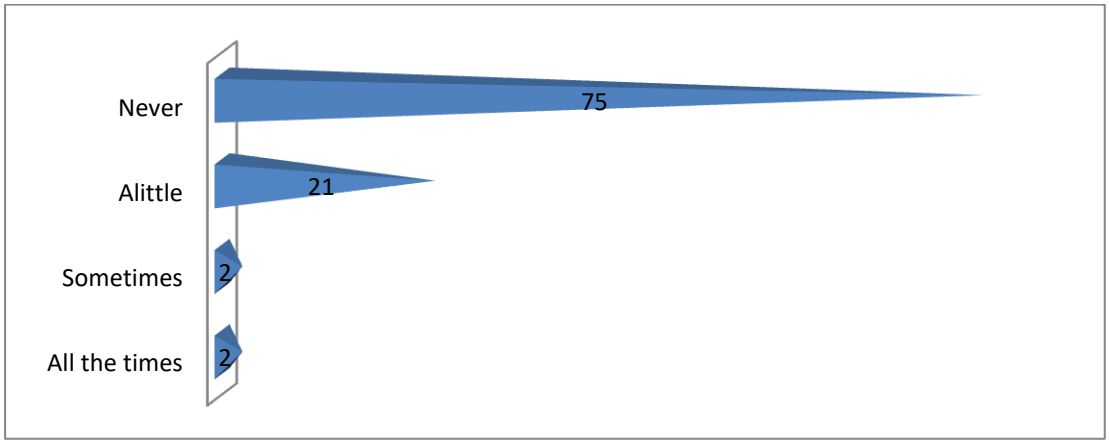

Figure 2.5: Difficulty in using computers

Source: Odhiambo (2010)

Positive and negative issues in regards to the use of Moodle as an e-learning platform have attracted research by academic and scholarly reviews. It is depicted that e-learning is an instruction which is given through electronic means and it includes use of the internet, hypermedia or hypertext documents, extranet and intranet. Rosenberg, Grad and Matear, (2003) explained that e-learning may be as effective as strategical instructions used in the past. Cavanaugh, (2001) added that there are slight differences in regards to academic performance between the traditional and technology-oriented forms of instruction. Other researches and reviews move an extra step to show the positivity involved due to the effects of e-learning (Mayer, 2005). The research demystifies e-learning by focusing on how Moodle and certain e-learning factors such as the online duration, socio-demographic features and computer knowledge influence the academic performance of an individual.

Odhiambo, (2010) noted that most researches have an identical idea that different methods of teaching and learning may have varying levels of success. Furthermore, this can be measured through monitoring the academic results produced (Emerson & Taylor, 2004). For instance, in reference to online teaching, some researches show that this method of teaching has a positive effect on academic performance. However, as Johnson, (2005) highlighted, other researches show that greater online teaching impacts performance negatively.

Chambers, (2003) added that e-learning would have a positive impact on the success of the learner in multiple subjects. In addition to these, other e-learning benefits include: Increase in school enrollment or having more time in school since the learning programs are extended to undeserved regions, and more educational opportunities are provided for students who cannot attend traditional learning institutions. Other are interaction between students and teachers improve and resources which are not locally available to the instructors can easily be accessed (Odhiambo, 2010).

Students learning in virtual schools showed greater improvements in the following areas based on the observation done by Barker & Wendel (2001); operating computers, solving problems, making decisions, managing time, researching, learning independently and critical thinking. Compared to students who learn under the traditional classroom instruction, other studies have shown academic advantages for students in a learning program located in Mexico Telesecundaria who demonstrated that they had more chances to pass their final examination which had been issued by the state. Other students who were included in this statement include students undertaking chemistry through a satellite course and students learning mathematics and reading through the interactive radio instruction.

(Odhiambo, 2010) explains that e-learning is not always effective in every learning situation. This is due to some reasons which include: The parents may have concerns on the student's social growth, the online environment may use languages which are not understood by some students, the learners may experience isolation, lessons with physical skill demonstration such as music may be at a disadvantage and in a technological setting, and foreign languages might be un-practical. Subjects with high technicalities also prove to be difficult in online teaching. Based on the end of year tests evaluation done by Alberta Online Consortium, students in virtual schools lagged behind in mathematics and science subjects in the province compared to students from non-virtual schools (Schollie, 2001). The lack of physicality combined with the distance between students and teachers in a music subject had negative impacts in the quality of performance, engagement of students in the lesson and the refinement and development of knowledge and skills. Students in virtual schools show poor progress than the ones in conventional schools especially in speaking and listening skills (Barker & Wendel 2001).

One key characteristic that separates successful distance students from their counterparts who physically attend classes is autonomy and the responsibility from the students.. Another feature separating successful students who are not classroom-based from the unsuccessful ones is the internal locus of control (Rotter 1989).

If e-learning students were given equal quality instruction to their counterparts in the classroom, they would perform equally according to (Kearsley 2000). Adult learners have had the delivery systems well documented and equaled over the years. Evidence collected from past years to date shows that education delivered through electronic means which is e-learning through Moodle would improve what and how students learn while delivering quality learning chances to all students.

2.3 The roles played by Moodle e-learning components/features in enhancing the student academic performance:

Studies have shown that the manner in which the user interface of a system is designed can affect the over whole understanding of a system also the performance of leaners in their respective courses. According to Odhiambo (2010) their study showed the data below upon analysis;

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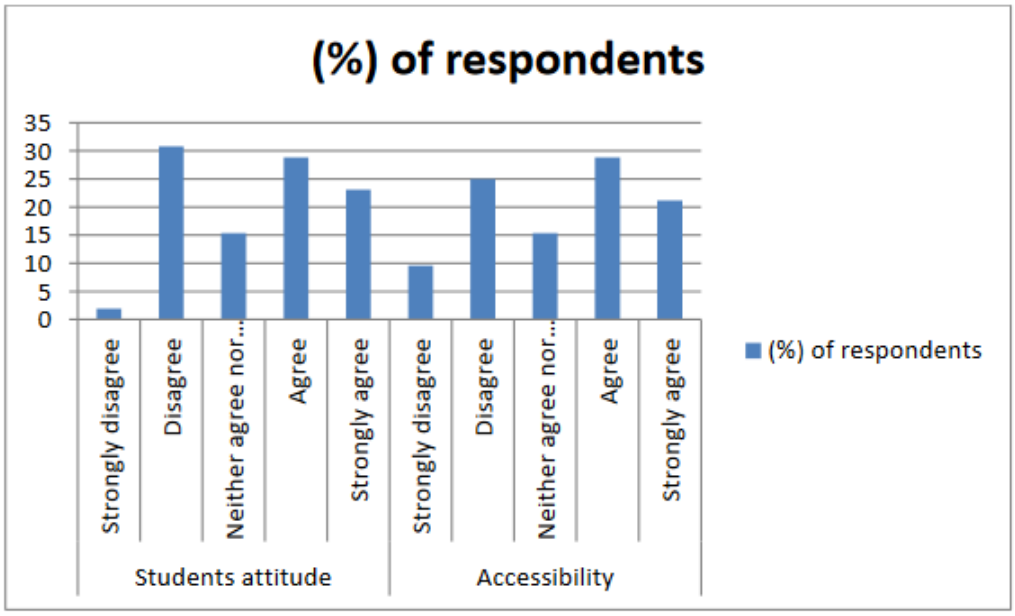

Figure 2.6: User interface issues with e-learning platform

Source: Author 2014

2.4 The Role of Socio-Demographic Characteristics on AcademicAchievement:

There are many studies conducted to determine the relationship between socio-demographic characteristics and academic performance such as a "study by Shana, 2009 done to gauge the influence of socio-demographic factors while using e-learning platforms on educational outcomes. The study specifically examined the impact of using online forum-based discussions on the performance of students enrolled in distance education programs and courses(Alhothli, 2015). The study took place at Ajman University of Science and Technology in the United Arab Emirates. The process was implemented on 34 enrolled students which were divided into two groups: the experimental group and control group, which were instructed in technology-based and traditional methods respectively. One-to-one interviews and surveys were conducted after both groups completed the test material. The study therefore concluded, based on collected and analyzed data that the experimental group, which was instructed with the aid of online forums performed noticeably better than the control group (Shana, 2009).Pertaining to influence of socio-demographic characteristics on performance, several studies have focused on specific socio-demographic factors and e-learners' academic performance, motivation, characteristics or areas such as gender and learning styles (Marlow, 2015), ethnicity and learning styles (Zinkham et al., 2012), academic performance and learning styles in both Information Technology and Traditional learning methods, subject areas and contact courses level of educational attainment, number of children in the family, full-time work experience, family income level (Abdul-Rahaman, 1994), age, marital status, employment status (Odhiambo, 2010), number of hours employed per week, distance, learners' previous educational background(Wang & Newlin, 2002)".

The results from the above research studies had several findings that differed from one another with some finding being related largely. For example, a study that was conducted by Woodbury et al.(2002) on first year programming courses, determined, "there was a relationship between student learning methods and academic performance, Similarly, Powell et al. (2011) established that marital status, gender and financial stability contributed significantly on academic performance of the distant leaners. From these findings, it appears the study on relationship between the socio-demographic factors and academic performance remains incomplete.

The study by Umek et al., (2015) on finding out if the introduction of the blended learning with support of the Moodle platform had increased the students' performance. They analyzed and compared two indicators of students 'performance, namely students' average grades and average required admissions to pass an exam in the years 'with Moodle 'with the (previous) years without it. Their study showed the results below;

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Table 1. Students enrolled in each academic year – in study years of both programmes (PS – Professional Study Programme and US – University Study Programme)

Academic year		Moodle – NO			Moodle – YES		
		1st	2nd	3rd	1st	2nd	3rd
2008/09	PS	213	0	0	0	0	0
	US	278	0	0	0	0	0
2009/10	PS	114	0	0	0	0	0
	US	208	210	0	0	0	0
2010/11	PS	157	0	96	133	0	0
	US	163	191	138	148	175	0
2011/12	PS	119	0	0	156	0	89
	US	108	140	147	109	0	0
2012/13	PS	0	0	0	133	0	65
	US	92	103	131	0	0	0
2013/14	PS	0	0	0	110	0	67
	US	0	0	0	93	80	82

Source: Survey, 2014

Figure 2.7: Performance while using blended learning on Moodle and without

The following are some of the key individual characteristics that may influence the use of online platforms like Moodle; motivation, computer skills, literacy skills, communication skills, and learning styles. Harnish et al (2012). According to this very study by Harnish(2012), it is clearly pointed out that*quasi-open computer-mediated environments are not safe places for students unsure of their writing skills and knowledge, online learning might not be appropriate for all students*". Looker et al (2013) conducted a survey using Canadian high school students and found out that females demonstrated less interest when seeking to achieve computer competency and literacy. This therefore clearly demonstrates that the various socio-demographic factors have impact on the academic performance and therefore on the use of Moodle e-learning platform, it is imperative to find out how these demographic variables affect the learners

2.5 Theoretical Framework:

The focus of this study was based on constructivist theory and facilitation theory. These are the most popularly used theories in the taxonomy of online learning. Eccles (1999) puts it that in order to for teachers to be in a position to improve student preparedness and instruction when learning through an online environment, these theoretical underpinnings are necessary.

2.5.1 Constructivism Theory:

This involves people having their own reasoning on the world by reflecting on their past experiences. When students discover new things, they relate them to previous experiences and knowledge. They may change their believe on the subject or dismiss the information and regard it as irrelevant. In order to be more creative on their findings, they have to explore what they already know, assess and be able to ask questions on the issue. In classrooms, students are encouraged to use active methods, which include experiments and problem solving in the real world through authentic data thereby creating a reflection and knowledge on their understanding.

Constructivism modifies the tutor's role helping the teachers to develop their own knowledge instead of reproducing certain facts. Constructivist teachers give their students problem-solving tools and other inquiry-based learning methods such as the electronic learning setups in order for the student to come up with their own ideas, inferences and conclusions and understand their knowledge in an interactive studying environment. The teacher should build on the pre-existing student's conceptions after understanding them in order to be able to guide the activities. The constructivist teachers teach their students on how to assess certain activities and how they can help them gain an understanding. Through questioning their own strategies, the knowledge of students grow and they become excellent learners in the process through the use of computers may it be offline or online. Additionally, the students become life-long learners since they have acquired the necessary tools.

2.5.2 Facilitation Theory (The Humanist Approach):

The facilitation theory is a learning theory which was introduced by Carl Rogers. The theory suggests that human beings make learning possible since they have "natural eagerness to learn" and they are solely responsible for person-centered

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learning. Despite a student's location, e-learning is possible since the individuals are eager to discover new things and are self-driven. Efforts from the teacher cannot guarantee the required success unless the student has the desire to learn since the teacher only acts a facilitator.

The Roger's Facilitation Theory suggests that learning has to involve the change of someone's concept. In order to facilitate change, one has to discover their weaknesses or strength. The e-learning setup enables the learners to perceive the possibility for knowledge acquisition in the system.

2.6 Conceptual Framework:

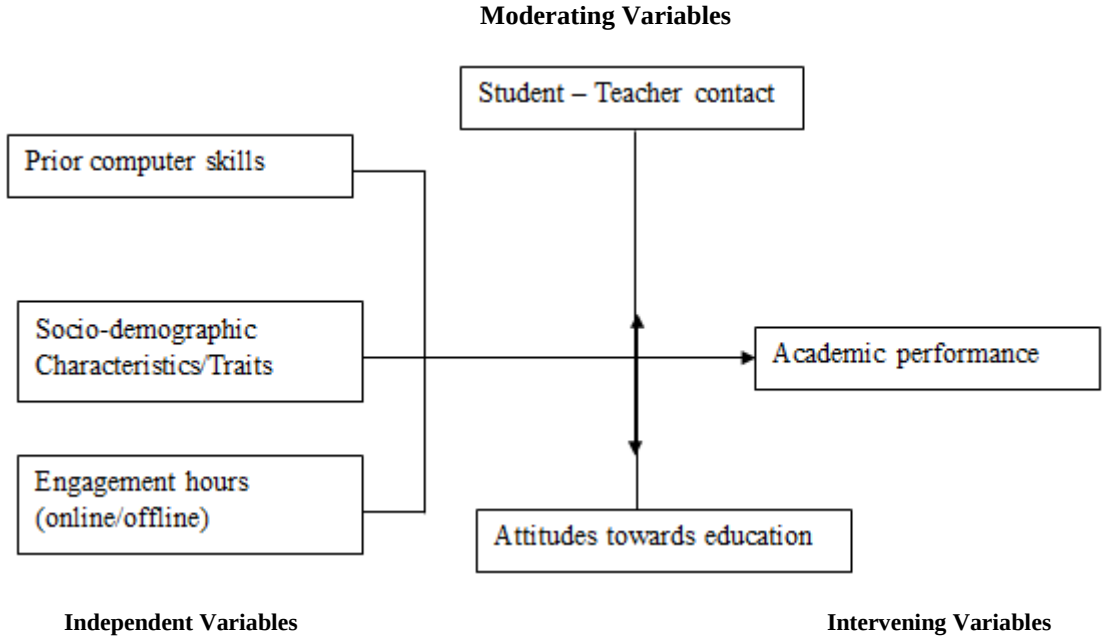

Figure 2.8: Conceptual Framework

3. RESEARCH METHODOLOGY

This" chapter deals with description of the methods applied in carrying out the research study. It therefore required that the procedures to be used in handling this study be clearly described. The following are the main key sub-sections in which the research methodology was organized into; Research design, target population, sample size and sampling technique, research instruments, data collection procedures and data analysis.

Research design:

A research design is the organized structure of the research that holds all the elements in a project (Kombo & Tromp, 2006). Research design therefore constitutes the blueprint for the collection, measurement and analysis of the research data. The research design to be used for this study is descriptive survey design. According to Orodho (2003) descriptive survey is a method of collecting information by way of interviewing or administering questionnaire to a sample of individuals and then establish the relationships of the data gathered. In this study, the researcher sought to establish the relationship between prior computer skills; socio-demographic characteristics; and level of student engagement effect on academic attainment while using the Moodle platform for learning. Descriptive survey is a method of collecting information by way of interview or administering questionnaires to a sample of individuals.

Target Population:

This refers to the larger group from which the sample population was taken. The researcher should find out as much as possible about the study population. Nachmias & Nachmias (1996) describe the target population as the most elementary part of the phenomenon to be studied. The study population entailed the departments in SODEL both learners and staff from a period of 2018 to 2019 and also face to face students in the school of computing". The study targeted to access information from three groups of resource persons; the students in these departments.

Sample size and sampling procedure:

The researcher must identify and define the accessible population from the target population. It is therefore important to decide on the sample technique to use in order to get appropriate sample size for the study.

Sample size:

Sample size means individual or group of persons that participated in the study. It is important to use the largest sample possible because statistics calculated from a large sample are more accurate. A sample of 500 students was drawn from the entire e-learning students' population within the departments that are in SODEL using Moodle. According to Kasomo (2007) for descriptive survey, 10% of the accessible population is enough sample to be used by a researcher. The sample size for this study was therefore 50 students sampled from the departments found within SODEL.

***Sa*mpling procedure:**

According to Orodho & Kombo, (2002), this is the "process of selecting number of participants or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group. The systematic random sampling technique was used to get the number of students to participate in the study. To identify e-learning respondents in Moodle, a list of students was obtained from the institution, systematic random sampling was used to select fifty students. An online link was sent to the selected fifty students. From this link, the questionnaire would be accessed.

Research instruments:

In order to achieve the predesigned objectives, both primary and secondary data are to be considered to give opportunity of gathering the information that could not be obtained through the regular research procedure. The secondary data are to be obtained from already existing documented materials relevant to the topic of study, whereas the primary data are to be obtained by developing and administering questionnaires to the respondents. The questionnaire contained both open-ended and contingency questions. The open-ended questions were used because they give the respondent freedom of response. Whereas contingency questions were used to probe more information from the respondent. For this study, questionnaires were used to collect primary data. For this study questionnaire is preferred because of its confidentiality and even more importantly, it saves time and enhances reliability due to absence of interviewer bias.

Validity of research instruments:

This refers to the accuracy of inferences which are based on the research results. Validity is therefore the degree to which results obtained from the analysis of data accurately represents the phenomena under study (Mugenda & Mugenda, 2003). Validity has to do with how accurate the data obtained in the study represents the variables of the study. For this research, the validity of the research instrument is to be determined by conducting a pilot survey where the research instruments are pre-tested. The questionnaire was pre- tested to a selected sample which is similar to the actual sample the researcher intends to use in the study. The purpose of pre testing is to refine the questionnaire so that the respondents had no problems in answering the questions in the questionnaire.

Reliability of the research instruments:

This refers to the measure of degree to which a research instrument yields consistent results or data after repeated trials (Mugenda & Mugenda, 2003). Reliability in research is influenced by random error and as random error increases or decreases the reliability of measurement instrument is affected. Random error is the deviation from the true measure due to factors that have not been effectively addressed by the researcher. To test the reliability of the research instruments, the split-half technique is to be used. In this approach, the instrument is designed is such a way that there are two parts. The researcher administers the first part of the questionnaire to the respondents to answer and then the second part of the questionnaire is administered to the respondents to answer. Subject scores from the first part are correlated with scores from the second part using the correlation coefficient formula r.

Data analysis Techniques:

The essence of data analysis is to present the data that has been collected from the field in a more easy way that can easily be interpreted by the researcher and for this particular study, the data is to be analyzed using quantitative and qualitative

methods. The data collected through questionnaire was coded, summarized, and then edited for possible errors. Descriptive statistics was used for computing the data. Frequency distributions and percentages are presented in form of frequency tables. The data was processed using *Statistical Package for Social Sciences* (SPSS)".

4. RESULTS AND ANALYSIS

Introduction:

The purpose of this chapter is presenting the data that the researcher collected from the respondents through questionnaires. The data presented below was tabulated, and analysed through SPSS version 20.0 scientific analytical tool.

Response Rate:

For this particular study, the researcher administered 50 questionnaires to research participants within the SODEL department. To ensure a high questionnaire response rate the researcher presented the questionnaires to respondents at their free time and hence due to its straight forwardness they were able to fill and return within a few minutes. Due to the follow-up done, the total questionnaires after evaluation found to be fully filled and appropriate for analysis were 44. According to Orodho (2013) the response rate can be defined as the extent to which the gathered final data sets include all the participants sampled and can be calculated as the respondents given the questionnaires divided by total participants in the whole sample which includes even the non-respondents. In this case, 44 questionnaires translate to 88% a figure which Babbie (2002) recommends to be adequate. This has been shown in the table below.

Table 4.1: Response Rate

Category	Frequency	Percentage
Response	44	88.00
Non response	6	12.0
Total	**50**	**100.0**

Descriptive Analysis

Problems of Using Moodle E-Learning System

Table 4.2: Problems of Using Moodle E-Learning System

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Slow connectivity	36.4%	47.7%	15.9%	0.0%	0.0%
Inadequate infrastructure	38.6%	50.0%	6.8%	4.5%	0.0%
Lack of reliable power supply	29.5%	70.5%	0.0%	0.0%	0.0%
High cost involved	43.2%	45.5%	11.4%	0.0%	0.0%
Support from university administration and Staff	4.5%	9.1%	31.8%	22.7%	31.8%
Availability of Moodle System awareness	27.3%	36.4%	22.7%	6.8%	6.8%
Availability of adequate computer resources	11.4%	15.9%	13.6%	22.7%	36.4%
Positive attitude of students towards Moodle e-learning system	15.9%	18.2%	15.9%	20.5%	29.5%
Difficulty in accessing and using Moodle e-learning system	15.9%	25.0%	9.1%	34.1%	0.0%

In this question, the researcher wanted to know the thoughts of the respondents regarding the problems facing the usage of Moodle E-Learning System. The researcher asked about the issue regarding slow connectivity where 36% of the respondents strongly agreed, 48% agreed while 16% neither agreed nor disagreed. In relation to this factor, there were no respondents who disagreed. The study sought to know the respondents stand on the issue of inadequate infrastructure where 39% strongly agreed and half of the respondents (50%) agreed. However, 7% neither agreed nor disagreed while 5% disagreed and the study did not record any results for the strongly disagreed category. The researcher also asked about the lack of a reliable power supply where 30% of the respondents strongly agreed, the largest percentage of 70% agreed with the statement and the other categories did not record any results. On the issue regarding the high cost involved while using the Moodle e-learning system, 43% of the participants strongly agreed, 46% agreed with the issue and 11% neither agreed nor disagreed. The study did not record any results for the disagreement categories.

Another issue raised by the researcher was the support from the university administration. In relation to this issue, a small percentage of 5 strongly agreed while 9% of the respondents agreed. Respondents who were not sure of their stand registered 32% while 23% disagreed and 32% strongly disagreed. The availability of Moodle system awareness was supported by 27% of the respondents who strongly agreed and 36% who agreed on the issue. Respondents who neither agreed nor disagreed were 23% while those who disagreed and strongly disagreed formed percentages of 7 each.

Moving on, the researcher asked about the availability of adequate computer resources where 11% of the respondents strongly agreed and 16% agreed. 14% neither agreed nor disagreed while 23% and 36% disagreed and strongly disagreed respectively. Moreover, on the issue regarding the positive attitude of students towards Moodle e-learning system, 16% strongly agreed with the issue while 18% agreed. Another 16% neither agreed nor disagreed while 21% of the participants disagreed and 30% strongly disagreed. The final issue on this question asked by the researcher was about the difficulty encountered when accessing and using Moodle e-learning system. The results recorded were as follows; 16% of the respondents strongly agreed while 25% agreed. 9% neither agreed nor disagreed while 34% disagreed and there were no respondents who strongly disagreed.

The study sought to know the opinion of the respondents in regards to the usefulness of Moodle e-learning platform. The results taken were divided into various categories as recorded in the table above. The total number of respondents were 44 where 39 respondents with a percentage of 80 said that the Moodle e-learning system was useful and 9 respondents registering a percentage of 20 saying that it was not useful. The researcher divided the percentages into valid and cumulative percentages, which recorded similar results of 80% and 20% totalling to 100%.

The Impact of Moodle Open-Source E-Learning Platform on Academic Performance

Table 4.3: The Impact of Moodle Open-Source E-Learning Platform on Academic Performance

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I have performed better on the units done because of the Moodle open-source learning platform	4.5%	4.5%	15.9%	43.2%	31.8%
The Moodle open-source learning platform pushes individuals to study more on their own	6.8%	9.1%	13.6%	45.5%	25.0%
The Moodle open-source learning platform has increased knowledge and understanding of various subjects	4.5%	4.5%	22.7%	38.6%	29.5%
Compared to face-to-face learning, Moodle open-source learning platform steers better performance in academics	4.5%	13.6%	11.4%	29.5%	40.9%
The learning content on Moodle open-source learning platform is more compared to face-to-face learning	2.3%	4.5%	13.6%	50.0%	29.5%
The Moodle open-source learning platform motivates learners because of flexibility (learning at anytime, anywhere)	11.4%	9.1%	15.9%	45.5%	18.2%
Compared to face-to-face students, students on Moodle open-source learning platform remember more concepts learnt	13.6%	13.6%	18.2%	38.6%	15.9%
Getting a supplementary exam is easier when being a student who is enrolled in Moodle open-source learning platform	31.8%	36.4%	9.1%	11.4%	11.4%
It is easy to graduate when enrolled as a student in Moodle open-source learning platform	6.8%	9.1%	6.8%	40.9%	36.4%

The study gave some statements, which would be evaluated by the respondents in an aim to get their opinions on the various issues brought about by the researcher. The study wanted to know the impact of Moodle open-source e-learning platform on academic performance. First, the researcher asked the respondents whether they have performed better on the units done because of the Moodle open-source learning platform. Results from the table above shows that 5% of the respondents strongly disagreed, another 5% disagreed and 16% neither agreed nor disagreed. 43% agreed to the statement

and 32% strongly agreed. The researcher also asked whether the Moodle open-source learning platform pushes individuals to study more on their own. 7% of the respondents strongly disagreed, 9% disagreed, 14% neither agreed nor disagreed, 46% agreed and 25% strongly agreed.

Another issue brought up by the researcher was whether the Moodle open-source learning platform has increased knowledge and understanding of various subjects. 5% of the respondents strongly disagreed, 5% disagreed, 23% neither agreed nor disagreed, 39% agreed to the statement and 30% strongly agreed. The participants were asked whether compared to face-to-face learning, Moodle open-source learning platform steers better performance in academics. 5% of the participants strongly disagreed, 14% disagreed and 11% neither agreed nor disagreed. Most of the respondents in this issue were in agreement with the statement with 30% agreeing to the statement and 41% strongly agreeing.

In relation to the question whether the learning content on Moodle open-source learning platform is more compared to face-to-face learning, 2% strongly disagreed and 5% disagreed. The results also show that 14% of the participants neither agreed nor disagreed while half of the respondents forming 50% agreed to the statement and another 30% strongly agreed. The participants were also asked whether the Moodle open-source learning platform motivates learners because of flexibility (learning at anytime, anywhere). Answers to this question were as follows; 11% and 9% strongly disagreed and disagreed respectively while 16% neither agreed nor disagreed. 46% of the respondents agreed to the issue while 18% strongly agreed.

The researcher wanted to know whether in comparison to face-to-face students, students on Moodle open-source learning platform remember more concepts learnt. The respondents gave their opinions with 14% strongly disagreeing and another similar percentage disagreeing with the statement. Moreover, 18% neither agreed nor disagreed while 39% agreed and another 16% strongly agreeing. The respondents were asked whether getting a supplementary exam is easier when being a student who is enrolled in Moodle open-source learning platform. 32% strongly disagreed and 36% disagreed with the study question. 9% neither agreed nor disagreed while 11% and another 11% agreeing and strongly agreeing. Finally, the study sought to know whether it is easy to graduate when enrolled as a student in Moodle open-source learning platform. In this question, 7% strongly disagreed while 9% disagreed. The question had 7% of the respondents neither disagreeing or agreeing. Most of the respondents were in agreement with this statement with 41% agreeing and 36% strongly agreeing.

Inferential Statistics:

Through SPSS analysis version 20.0; the researcher conducted inferential analysis generating correlation results, model of fitness, and ANOVA and regression coefficients.

Correlation Analysis:

Table 4.4: Correlation Analysis

		Average Social Demographic	Average Problems	Average Feature	Average Computer Skills	Average Moodle Academic Performance
Average Social Demographic	Pearson Correlation	1	.481**	.271**	.521**	.594**
	Sig. (2-tailed)		.000	.000	.000	.000
Average Problems	Pearson Correlation	.481**	1	.482**	.578**	-.326**
	Sig. (2-tailed)	.000		.006	.000	.001
Average Feature	Pearson Correlation	.271**	.482**	1	.395**	.672**
	Sig. (2-tailed)	.000	.006		.008	.000
Average Computer Skills	Pearson Correlation	.521**	.578**	.395**	1	.649**
	Sig. (2-tailed)	.000	.000	.008		.000
Average Moodle Academic Performance	Pearson Correlation	.594**	-.326**	.672**	.649**	1
	Sig. (2-tailed)	.000	.001	.000	.000	

In order to establish the degree of association between the variables in this particular study; academic performance, moodle problems, features of moodle, and computer skills, Pearson correlation was used. The coefficients of Pearson range between +1 and -1 where the positive value depicts positive correlation while negative value negative correlation. A negative correlation means that in the relationship between the two variables under consideration, when one decreases the other increases and vice versa. From the results shown in the Table, there are three variables which have a positive and significant correlation to academic performance in this case computer skills, social-demographics and moodle features. However, there is a negative correlation between problems of using the Moodle learning system and academic performance. The results shows that there is a positive and significant correlation between features of the Moodle system and academic performance (r=0.672; p=.000). On the other hand, the results show a positive and significant relation between computer skills and academic performance (r=0.649; p=.000). Nonetheless, the results depict a moderate negative relation between problems of Moodle learning system and academic performance (r=-.0326; p=.001). In addition, there is a positive and significant relationship between social demographics and student academic performance (r=.594; p=.000). Normally, the interpretation of these figures is that if the Sig (2-tailed) is less than 0.05, a conclusion can be made by the researcher to indicate that the variables have a significant correlation and vice versa. For the negative correlation, it means that if the problems of using Moodle learning system increases or decreases, academic performance by the students decreases or increases respectively.

The impact of each of the independent variables on the dependent variable (student academic performance) can be ranked as follows: the features of the Moodle learning system has the greatest impact on the academic performance of the students with 67.2%, followed closely by computer skills and knowledge with 64.9% and social demographics with 59.4%. For the problems of Moodle learning system, the impact is inversely related where a decrease in the problems means increase in student academic performance while an increase in problems means decline in student academic performance.

Regression Analysis:

A multiple regression was conducted to establish the relationship between the dependent and independent variables. R square was done to depict the appropriateness of a term predicting another. In other words, R square is used to explain how student academic performance varies with problems of the Moodle, Moodle features, social demographic and computer skills and knowledge. According to the Model Summary below, the three predictors (independent variables) can explain 66.6 percent of student academic performance. This implies that the remaining 33.4 percent variations in student academic performance can be explained by other factors that the present study did not cover.

Table 4.5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.816[a]	.666	.641	.660

Table below shows the Analysis of variance (ANOVA). According to the results, it is clear that the model is statistically significant which is supported by (F=26.60; p=.000). Consequently, it is clear that there was no chance in finding out that the variables had a relationship.

Table 4.6: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.727	3	11.576	26.603	.000[b]
	Residual	17.405	40	.435		
	Total	**52.131**	**43**			

The final aspect of the regression is to make a comparison of the contribution of each of the independent variables, problems of the Moodle system, Moodle features, social demographic components and computer skills into the dependent variable (student academic performance) through looking at the beta values (βs). The results showed that problems of Moodle learning system negatively and moderately affected student academic performance (β=-.315, *p*=.033) while feature of the Moodle learning system positively and significantly affects student academic performance (β=.525, *p*=.000). In addition, the study results depict that socio-demographic positively and significantly affects the academic performance of students (β=.643, *p*=.000). Finally, computer knowledge or skills positively and significantly affect student academic performance (β=.643, *p*=.000).

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Table 4.7: Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.307	.460		.284	.029
	Average socio-demographic	.423	.119	.423	3.555	.000
	Average Problems	-.315	.143	-.210	-2.203	.033
	Average Feature	.525	.108	.485	4.873	.000
	Average Computer Skills	.643	.129	.516	4.998	.000

a. Dependent Variable: Average Moodle Academic Performance

From the multiple regression results in the table above, the equation:

$Y= a+\beta1X1+\beta2X2+ \beta3X3 + \beta4X4+ \varepsilon.$

$Y= 1.307+.423X_1+-.315X_2+.525X_3+.643X_4+ \varepsilon.$

Y =Student Academic Performance

X1= Socio-demographic

X2 = Problems of Moodle learning system

X3 = Moodle Features

X4 = Computer knowledge/ skills

ε' = error term

5. SUMMARY, CONCLUSION AND RECCOMENDATIONS

Introduction:

The purpose of this chapter is to represent the summary of the study findings, make conclusion and appropriate recommendations for consideration.

Summary of findings:

The general objective of this study is to establish the impact of Moodle Open-Source E-learning Platform on academic performance. The specific objectives were to determine problems students experience while using the Moodle system and how they affect the academic performance of learners, to determine how prior computer skills and knowledge affects the learners' academic performance while using Moodle, and to determine the roles played by Moodle e-learning components/features in enhancing the student academic performance. Finally, the study sought to examine how socio-demographic factors of learners affects their academic achievement of Moodle users. A case study approach was applied where data was collected from the SODEL department in JKUAT.

A sample of 500 students was be drawn from the entire e-learning students' population within the departments that are in SODEL using Moodle. According to Kasomo (2007) for descriptive survey, 10% of the accessible population is enough samples to be used by a researcher. The sample size for this study was therefore 50 students sampled from the departments found within SODEL. The response rate according to the returned questionnaires was 88 percent considering that 6 questionnaires were not fit for analysis.

Problems leaner's face when using Moodle system experience and how do they affect academic performance:

According to the study findings, learners who use the Moodle learning system experience some problems which eventually affect their academic performance. It was evident that from the results, there are those factors that are a major challenge compared to others. For instance, the study sought to know the respondents stand on the issue of inadequate infrastructure where 39% strongly agreed it was a problem and half of the respondents (50%) agreed. However, 7% neither agreed nor disagreed while 5% disagreed and the study did not record any results for the strongly disagreed category. Moreover, on the issue of lack of a reliable power supply; 30% of the respondents strongly agreed it was a problem, 70% agreed with the statement and the other categories did not record any results. On the issue regarding the high cost involved while using the Moodle e-learning system, 43% of the participants strongly agreed, 46% agreed with the issue and 11% neither agreed nor disagreed.

The results depicted a moderate negative relation between problems of Moodle learning system and academic performance (r=-.0326; p=.001). The results also showed that problems of Moodle learning system negatively and moderately affected student academic performance (β=-.315, *p*=.033).

Roles played by Moodle e-learning components/features in enhancing the student academic performance:

The findings depict that the e-learning features/ components play a significant and positive role in enhancement of the student academic performance. On the courses feature, the study registered 5% and 16% of the respondents who strongly agreed and disagreed respectively. 27% of the respondents neither agreed nor disagreed while 34% agreed and 18% strongly agreed.

Another component was 'my latest badges' whose results were recorded as follows; 5% strongly disagreed, 7% disagreed, 34% neither agreed nor disagreed, 31% agreed and 23% strongly agreed. The calendar was also found to be an important feature to student's academic performance.

The results shows that there is a positive and significant correlation between features of the Moodle system and academic performance (r=0.672; p=.000). The findings also depict that feature of the Moodle learning system positively and significantly affects student academic performance (β=.525, *p*=.000).

Determine how socio-demographic factors of learners affect their academic achievement of Moodle users:

In relation to the socio-demographic factors, the findings show there is a positive and significant effect on the academic achievement of the Moodle users. Among the most influencing aspects of socio-demographic include the level of education and the employment status. The results depicted that 75% of the respondents were employed. Moreover, majority of the respondents were aged between 21 to 35 years which represented 52% followed by those aged from 36 to 50 years with 32 percent. Finally, most of the respondents at the time of the survey were pursuing a Master's degree. According to the findings, there is a positive and significant relationship between social demographics and student academic performance (r=.594; p=.000). Finally, according to the regression analysis findings, socio-demographic positively and significantly affects the academic performance of students (β=.643, *p*=.000).

Determine how prior computer skills and knowledge affects the learners' academic performance while using Moodle:

Prior computer skills and knowledge were found to have a significant effect on the academic performance of learners using the Moodle. Most of the respondents had no phobia when using computers. In addition, majority stated that computers did not scare them. Most of the respondents also agreed saying that it was easy for them to complete online courses with their level of computer skills. The results show a positive and significant relation between computer skills and academic performance (r=0.649; p=.000). The regression analysis depicts that computer knowledge or skills positively and significantly affect student academic performance (β=.643, *p*=.000).

6. CONCLUSION

The main aim of the study was to establish the impact of Moodle Open-Source E-learning Platform on academic performance. The results revealed that except problems of using Moodle learning system which had a negative moderate correlation, the rest of the variables, socio-demographic, prior computer skills and knowledge, and the Moodle features have a positive and significant relation to the academic performance of students.

The impact of each of the independent variables on the dependent variable (student academic performance) can be ranked as follows: the features of the Moodle learning system has the greatest impact on the academic performance of the students with 67.2%, followed closely by computer skills and knowledge with 64.9% and social demographics with 59.4%. For the problems of Moodle learning system, the impact is inversely related where a decrease in the problems means increase in student academic performance while an increase in problems means decline in student academic performance.

It can be concluded that a unit change in socio-demographic would lead to .423 units change in the student academic performance. Secondly, units change in problems of Moodle learning system would lead to -.315 units change in student academic performance. This means an increase in problems of the Moodle system would decrease academic performance of the students and vice versa. In addition to this, a unit change in Moodle features would lead to .525 unit change in student academic performance. Finally, a unit change in prior computer knowledge and skills would lead to .643 changes in student academic performance.

7. RECOMMENDATIONS

There are numerous recommendations which can be made following the findings of the present study for consideration. First, it is recommended that, institutions such as JKUAT should make huge investments in the Moodle learning system to ensure that problems that students might face are minimized. For instance, students should be able to get immediate assistance from a support staff when they are unable to locate some course materials or when seeking some information. Awareness efforts should be increased and so is the need to increase computer resources for the Moodle users.

It is also recommended that students who seek to use Moodle learning system should acquire prior knowledge and skills on computer. Considering that the learning is online, the use of computer is necessary failure to which an individual will be unable to navigate within the system. It should be the duty of the study to gain computer skills and knowledge before enrollment for their maximum benefit.

Finally, for the developers of Moodle learning systems, they ought to include features which are simple and clear. Students within the platform should have no serious difficulties accessing course materials or interacting with their unit lecturers. Therefore, constant upgrades should be done to the Moodle learning system to accommodate new needs and requirements

Suggestion for future research:

In Kenya the e-learning technology is a new phenomenon which means that not many studies have been conducted in relation to how different aspects impact on the performance of student academic performance. In future, a comparison study can be conducted with face-to-face students and establish the differences with Moodle learning system. A similar study could also be conducted in a private university that has the Moodle learning system.

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