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Integrating Learning Management System and Digital Library for Students' Assessment

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ABSTRACT

Information and Communication Technology (ICT) has recently advanced in education sector where teachers and other educational stakeholders use learning management system (LMS) to improve students learning. Tanzania in the meantime, has implementing multiple initiatives aimed at enhancing ICT integration in education. The initiatives includes connection of National ICT broadband backbone, implementing various ICT projects such as Tanzania Education and Research Network (TERNET) and the use LMS and digital library (DL) through Tanzania Institute of Education (TIE). Apart from the government initiatives, a critical gap exists in the knowledge and proficiency of both tutors and students in utilizing LMS and DL skills to enhance creativity. This study seeks to address this issue by exploring the integration of LMS and DL to preserve the talents and skills of educators and students. The research utilized a mixed-method approach that involved questionnaires and interviews from tutors. Data were analyzed both inferentially and descriptively. The study found that 33% of tutors were competent to ICT skills related to LMS and DLs. Furthermore, the study proposed a digital library system (DiLaS) prototype as a blueprint for integrating LMS and DLs to support students in learning and assessment. The paper recommends that the government should draw policy strategies that support innovation in digital systems to preserve exceptional skills.

***Keywords**:* Retention of talented skills, learning management systems (LMS), ICT skills, and digital library

INTRODUCTION

Learning management system (LMS) refer to the computer software that designed to manage user-learning interventions and provide access to online learning services for students, teachers, and administrators. It is used to upload, teach, and assess learning processes. Historically, the LMS started in 1960s where it was known as an offline LMS. It was not supported by the web-based systems (Rashid & Ullah, 2021). The LMS has passed through various evolutions, including the recent LMS such as google classroom and Edmodo. The use of LMS in African countries has not been effective due to technological challenges. The adoption of LMS in Tanzania has not implemented widely since very few universities and colleges use LMS in teaching their courses. For instance, during covid-19, all universities and colleges were closed implying that utilization of LMS was affected. LMS has the unique features which differentiate with other software and social media such as WhatsApp and Facebook.

The features of LMS includes Instructional features; they are used in course development, creation of assignments, test and management of the course. The content management features enable instructors to upload teaching materials such as files, slides, PDFs, audio files, and videos. On the other hand, it enables the student to upload the activities provided in the learning platform. User management features involves importing and exporting user accounts in LMS. In addition to that it creates and manages user accounts, group's accounts and maintenance of user passwords, profiles and other user's data. Interactive features enable communication between teacher and students. Some example of these features includes chat room, messaging, mutual uploading or downloading of files, digital drop boxes and the links for transfer files from LMS and other software such as Microsoft word and excel. Students and teachers should have an ability to post questions and receive answers from group members.

Visual features deal with visual appearance of the LMS platform. They include graphic interfaces, color, shapers of the buttons, font types, font sizes and link between one element and other elements. Digital library (DL) is an online database of digital objects that include text, still images, audio, video, digital documents, or other digital media formats. Xie, Joo and Matusiak (2020) defined DL as a representations of emergent and complex forms of collection of digital information, organization, design, storage, retrieval, and dissemination at various stages of development. Three distinct phases have characterized the development of DL. In the early years of DL, from 1991 to 2001, innovative and avant-garde projects were implemented in the actual world. The phase included a standards, iterative design, usability studies, and best practices for DLs have all been developed.

Secondly, in the 2000s, an open-access repositories and large-scale digitization projects were two features that contributed to content development. Though large-scale digitization initiatives improved the technology of DLs, the emergence of open-access repositories brought up questions about the diversity and complexity of DL development. Lastly, starting in 2010, large-scale DLs, such as the Digital Public Library of America, HathiTrust, and Europeana collections, are signified by their large collection size. Others include diversity of formats, general and specific collection development policies and the level of access and interoperability. Digital libraries designed to solve the challenges and implications of the library working in-house and remotely (Mehta & Wang, 2020). The physical library needs a user to be present in a room while DL do not require face-to-face appearance. The online collection includes e-books, e-newsletters, e-references, theses, and dissertations (Kato et al., 2021). Okeji and Mayowa-Adebara (2020) noted that as DL undergo various evaluation, majority of educators are also missing relevant knowledge on DL. Hamzah, Hultari, Purwati, and Nazaruddin, (2022) conducted research on the analysis of the

library information system (E-Library) based on the level of user satisfaction. The study revealed that 60.31 % of the users were quite satisfied with the performance of the DL (e-Library). Assessment in context of learning refers to strategies designed to confirm or measure what a student knows, demonstrate whether or not they have met curriculum outcomes or the goals of the running programs, or to certify proficiency and make decisions about students' future programs. Assessment includes strategies designed to monitor student progress during the learning process (Dunn & Mulvenon, 2019). In this case, it provides information that improves pedagogical practices and instructional outcomes in the classroom. The government of the United Republic of Tanzania has been implementing multiple initiatives aimed at enhancing ICT integration in education system.

The initiatives include; connection of National ICT Broadband Backbone in various educational institutions, implementing various ICT projects such as Tanzania Education and Research Network (TERNET) and the use of LMS and DL in Tanzania Institute of Education (TIE). Despite the initiatives made by the government of Tanzania to improve the status of ICT in TCs, full integration of ICT in the education system is still a challenge. A substantial number of teachers lack proficiency in computers including DL, LMS and multimedia skills (Fidelis & Onyango, 2021; Venance, 2020). Lubuva, Ndibalema, and Mbwambo (2022) found low levels of competence for tutors in ICT pedagogy to innovate teaching and preparation of digital contents for applying them in LMS. Okeji and Adebara (2020) conducted a study on evaluating the library school's curriculum in Nigeria. The study found that there is lack of qualified ICT staff to handle the course concerned with DL. It has further noted on the lack of computer laboratories equipped with modern computers with stable internet facilities. The objective of this study was to assess the integration of LMS and DLs for preserving and creating accessibility of

the exceptional talents and skills of educators and students. Talented skills can be either methodology of teaching or subject content. The preserved skills through DL will be assessed to student teachers through LMS. The talented students and teachers have passed away without documenting their works which could help the next generations. The research questions to be answered in this study are: 1) what are the software used by tutors to design multimedia content or notes? 2) What is the status of integrating LMS and DL in TCs? 3). what is the best prototype for developing digital library system (DiLaS)?

Methodology

Participants

Participants in this study were 340 tutors from ten TCs. The TCs were Butimba TC, Tabora TC, Mpwapwa TC, Morogoro TC and Korogwe TC. The above TCs have been selected because they are zonal ICT TCs so, they are well equipped with ICT infrastructure. In addition, the TCs are teaching computer science courses. Other five TCs were added from the regions near to the zonal TCs to minimize the cost and to obtain the required number of tutors. The additional TCs were Sumbawanga TC, Shinyanga TC, Mamire TC, Bustani TC and Dakawa TC.

Procedures

The research employed a mixed-methods approach that involved questionnaires from 320 tutors and interviews from 20 tutors in ten TCs. The study applied purposeful sampling to get zonal TCs. The researcher used a simple random technique to obtain 320 tutors for questionnaire because each tutor is responsible to integrate ICT in teaching his or her subjects (URT, 2007). 20 tutors for interview were purposeful selected from a principal for administrative matters and head of ICT department because of being expert in ICT.

Measures

The researcher adopted eighteen closed–ended questionnaires from (Batiibwe et al., 2017; Jude et al., 2014). The studies were selected because they used the similar model (SAMR) in measuring the status of ICT in academic institutions. Furthermore, the researcher added fifteen closed-ended questionnaires. Validity and reliability was confirmed by testing questionnaires with postgraduate students.

Statistical analysis

The study used multiple linear regressions with SPSS version 25.0 for inferential analysis. Tables, graphs, percentages, and frequencies from excel were used in the descriptive analysis for the purpose of obtaining the findings. Research ethics were considered because research clearance for TCs was sought from the University of Dodoma. There was equitable access to the data for every cluster including gender, program, and the year of study. The respondents' actual names during data collection were kept private to protect them from being victimized by their seniors.

Results

Background Characteristics of Tutors

The background information of tutors in TCs include their college affiliation, sex, age, teaching subjects, time spent in teaching TCs, and individual ICT background were taken into consideration. Generally, tutors participated well in providing their background information before attempting the questionnaires. Table 1 below provides an overview of the background details of tutors.

Table 1: Background Characteristics of Tutors

Items	Categories	Frequency (n)	Percentages (%)
College Participation	TC 1	30	9.4
	TC 2	25	7.8
	TC 3	20	6.3
	TC 4	23	7.2
	TC 5	57	17.8
	TC 6	13	4.1
	TC 7	22	6.9
	TC 8	37	11.6
	TC 9	68	21.3
	TC 10	25	7.8
Gender	Male	145	45.3
	Female	175	54.7
Age	Under 30 years	7	2.2
	30 to 45 years	237	74.1
	Above 45 years	76	23.8
Teaching subject	ICT	18	06
	Science	76	24
	Art	91	28
	Education	109	34
	Business	00	00
	Other	26	08
Number of years in teaching	Under 1 year	11	3.4
	2 to 5	137	42.8
	6 to 10	60	18.8
	Above 10 years	112	35.0
Academic qualification in ICT	Certificate	60	18.8
	Diploma	08	2.5
	Degree	33	10.3

	Masters	03	0.9
	Above Masters	00	00
	Non-ICT Profession	216	67.5
Attending ICDL	Attended	31	9.7
	Not attended	289	90.3
Attending ICT Short course	Attended	221	69.1
	Not attended	99	30.9
ICT profession development	E-learning	62	19
	Digital library	46	14.3
	Computer basics	80	25
	Other	44	13.7
	Not received	88	28

Software Used by Tutors to Design Multimedia Contents for DL and LMS

Teachers and tutors have a primary role of teaching, this is why the researcher asked about using software to create multimedia notes or contents for embedding in DL and LMS. The contents to be included in DL and LMS need enough visual aids to enable students understand the lesson easily. Power Point found to be used by 181 tutors (56%), followed by Lectora 18 (5.6%) and 55 (17.2%) were not able to use any software. Figure 1 below provides an overview of teachers' software-designing skills for multimedia content to impart in DL and LMS.

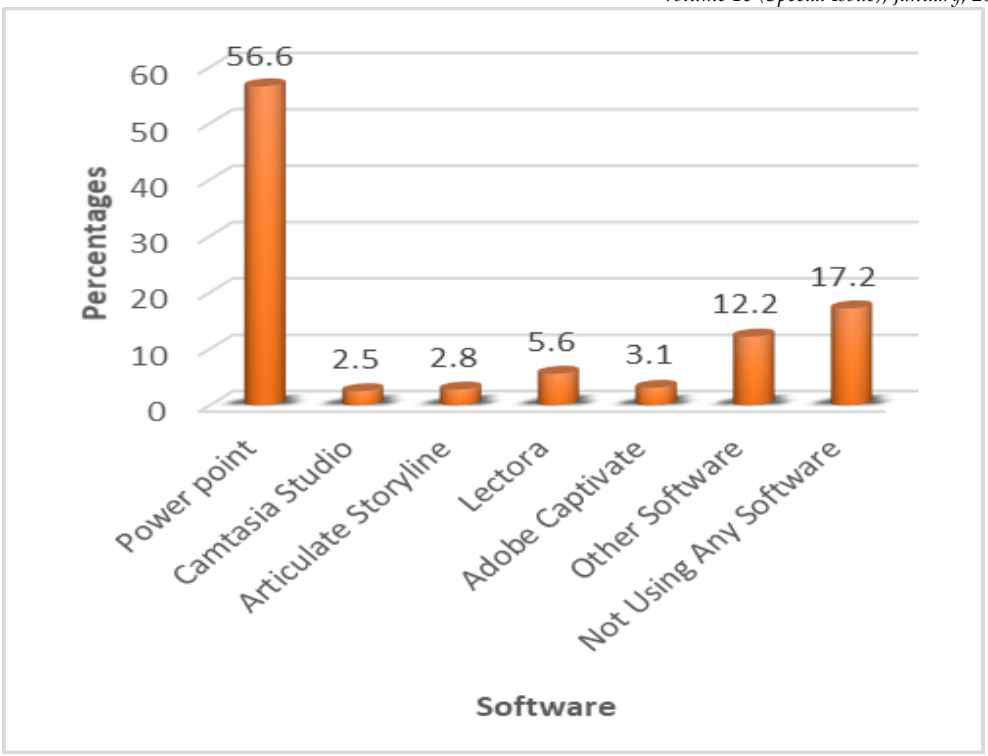

Figure 1: Multimedia Software used by Tutors for DL and LMS (Field data)

The Status of Integrating LMS and DL in Tanzanian TCs

The researcher used multiple linear regression to answer this objective. First, the researcher grouped the constructs relating with LMS and DL into four categories as adopted from Batiibwe et al. (2017) and Jude et al. (2014). The four groups were substitution, augmentation, modification and redefinition.

Testing of Assumptions

The key condition in multiple linear regression analysis is to ensure that the data meet the outliers, collinearity, and normality, amongst other assumptions, as interpreted in statistics (Field, 2017; Pallant, 2016). Multi-collinearity demonstrates extremely high or low correlations between independent variables. The study done by Pallant

(2016) explain a cutoff point (> .10) and variance inflation factors (VIF) below 10 as acceptable points in multiple regression tests.

Checking of Outliers on Competence in DL and LMS toward Methodology used by Tutors

The box plot analysis showed that there were no outliers. This implies that the data points within this analysis was closely around the central clusters. This implying a highly stable distribution and minimizing the potential impact of extreme values on the multiple linear regression assumptions. This result strengthens the linearity presumption and adds to the reliability of the next regression study. Appearance on outliers are summarized by figure 2 below.

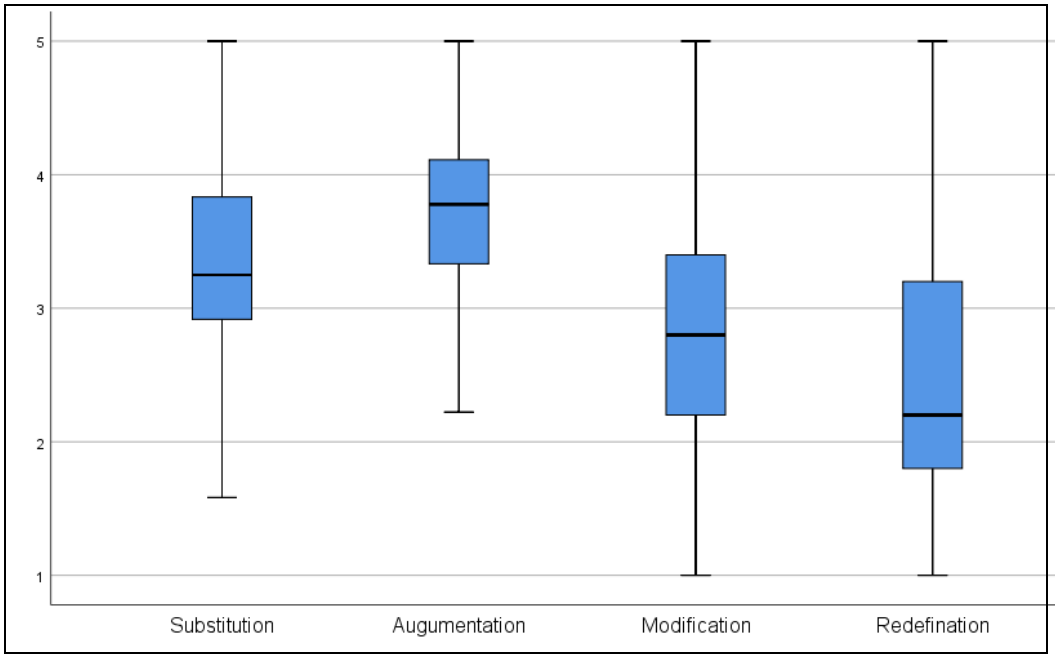

Figure 2: Outliers on Competence in DL and LMS (Field data)

Normality on Competence in DL and LMS

The observed data values are shown against the values that would be predicted if the data were normally distributed in a normal P-P plot. The plot's points should roughly lie along a straight line, sometimes

referred to as the "line of equality" or the "45-degree line," if the data has a normal distribution. Variations from this line signify deviations from the norm as shown in figure 3.

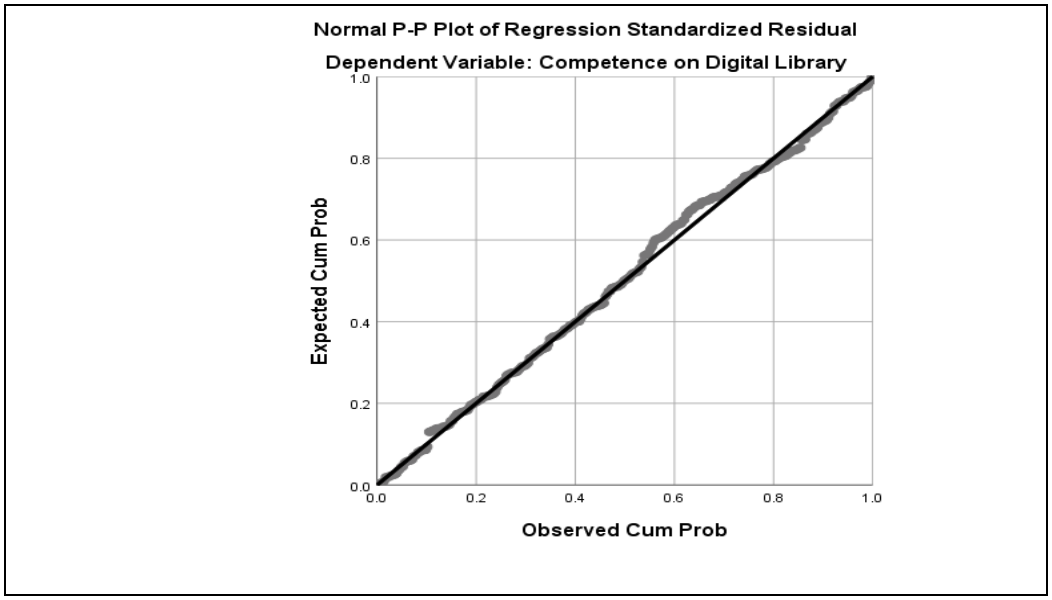

Figure 3: Normality on competence in DL and LMS (Field data)

Linearity on Competence in DL and LMS

Linearity involves interpreting a scatter plot in which every point for the data aligns precisely with the equality line. In this case, every data point on the scatter plot falls exactly on the line of equality, indicating a strong and linear relationship between the two variables. This points to a complete positive correlation, meaning that as one variable rises, the other rises correspondingly. Based on the linear relationship, accurate modeling and forecasting are made possible by this pattern, which indicates a very consistent and predictable association between the variables. The linearity is shown by figure 4 below.

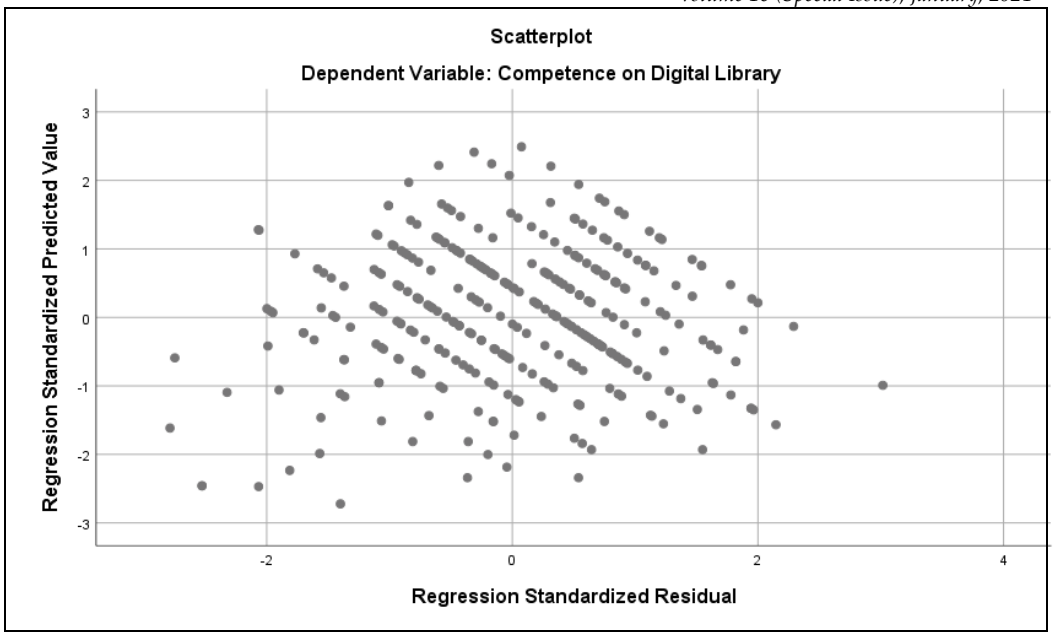

Figure 4: Linearity on Competence in DL and LMS (Field data)

Checking of Multi-collinearity on Competence in DL and LMS

The Variance Inflation Factor (VIF) values for the variables tolerance and competence on DL and LMS in the given data all fall below the generally recognized threshold of 5, showing the lack of multi-collinearity. This shows that there were no significant connection or redundancy between the two variables. Therefore, they are reasonably independent predictors in the analysis. Due to lack of interdependence between the variables, the association between the predictors and the dependent variable are more likely to be stable, which increases the regression model's reliability. Table 2 below show multi-collinearity on competence in DL and LMS.

Table 2: Checking of Multi-collinearity on Competence in DL and LMS

Competence on digital library	Tolerance	VIF
Substitution	0.615	1.625
Augmentation	0.609	1.641
Modification	0.422	2.369
Redefinition	0.460	2.176

Model Summary of Competence on DL and LMS

The regression model's R-squared value of 0.420, as reported in the model summary for "Competence on DL and LMS," means that the independent variable, "Competence on DL and LMS," can account for around 42% of the variance in the dependent variable. A substantial amount of the variance may be explained by this model while also taking the complexity of the model into consideration. This is indicated by the adjusted R-squared of 0.412, which takes the number of predictors into account. The mean difference between the observed and anticipated values is 0.553, which is the standard error of the estimate. A correlation between the variables' strength and direction is indicated by the R-value of 0.648. The model summary of competence on DL and LMS has been shown in table 3 below.

Table 3: Model Summary of Competence on Digital Library

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.648	0.420	0.412	0.553

ANOVA of Competence on DL and LMS

A statistically significant link between the competence levels and the dependent variable under investigation is revealed by the analysis of variance (ANOVA) for the effect of competence on DL and LMS. A

considerable amount of the total variance can be explained by the model. This has been shown by the regression sum of squares of 69.582 and the F-statistic of 56.924, both of which are significant at $p < 0.001$. This suggests that, variations in skills levels account for a significant portion of the variation in the dependent variable of 96.261. Basically, this is a reasonably low residual sum of squares. This indicates that a significant amount of the observed variation can be explained by the model. The ANOVA of competence in DL and LMS has summarized in table 4 below.

Table 4: ANOVA of Competence on DL and LMS

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69.582	4	17.395	56.924	0.000
	Residual	96.261	315	0.306		
	Total	165.843	319			

Coefficients of Competences in DL and LMS

The Competencies of DL and LMS coefficients in the presented regression study show the associations between the dependent variable and the predictors (Substitution, Augmentation, Modification, and Redefinition) with standardized coefficients of 0.575 and 0.202, respectively. The results demonstrate that substitution and augmentation have positive and statistically significant effects on the competencies of the DL and LMS. This suggests that an increase in these competencies is correlated with a corresponding increase in the competencies of the DL and LMS. Modification and redefinition, on the other hand, show weak or non-significant because their p-values are bigger than 0.05 and their coefficients are around zero. The constant term, which represents the baseline value for DL and LMS competencies when all variables are 0, is statistically significant. This analysis indicates that while modification and redefinition have little

effects on the competences of DL and LMS, substitution and augmentation are crucial. It is concluded that, tutors are more competence in integrating LMS and DL at substitution and augmentation levels than at modification and redefinition levels. The coefficients of competences of DL and LMS are summarized by table 5 below.

Table 5: Coefficients of Competences of DL and LMS

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.010	0.134		14.989	0.000
	Substitution	0.493	0.047	0.575	10.509	0.000
	Augmentation	0.165	0.045	0.202	3.668	0.000
	Modification	-0.019	0.055	-0.023	-0.353	0.740
	Redefinition	-0.057	0.048	-0.076	-1.192	0.128

The status of integrating LMS in Tanzanian TCs were further assessed with interviews from Principals and ICT tutors from ten TCs. Principals and ICT tutors from ten TCs were interviewed. It was recorded that eight TCs out of ten TCs were not using LMS. The lack of internet access for TCs was cited as the reason for not using LMS. A different respondent mentioned that some TCs' management do not have a positive attitude toward ICT integration. It was also noted that in previous years there was a TC claimed to use LMS without internet connection.

Educational ICT Prototype System from Literature Review

The prefix prot or proto, comes from Greek word meaning "first in time" or "first formed." A prototype refer to something that serves as a model or inspiration for activity that come later. The study done by Shao (2014) explored the use of mobile phones to support students

learning activities in mathematics for primary and secondary schools. A researcher proposed MoMath prototype on how SMS and IVR can be leveraged to support students in studying mathematics. Figure 5 below show the summary of MoMath prototype.

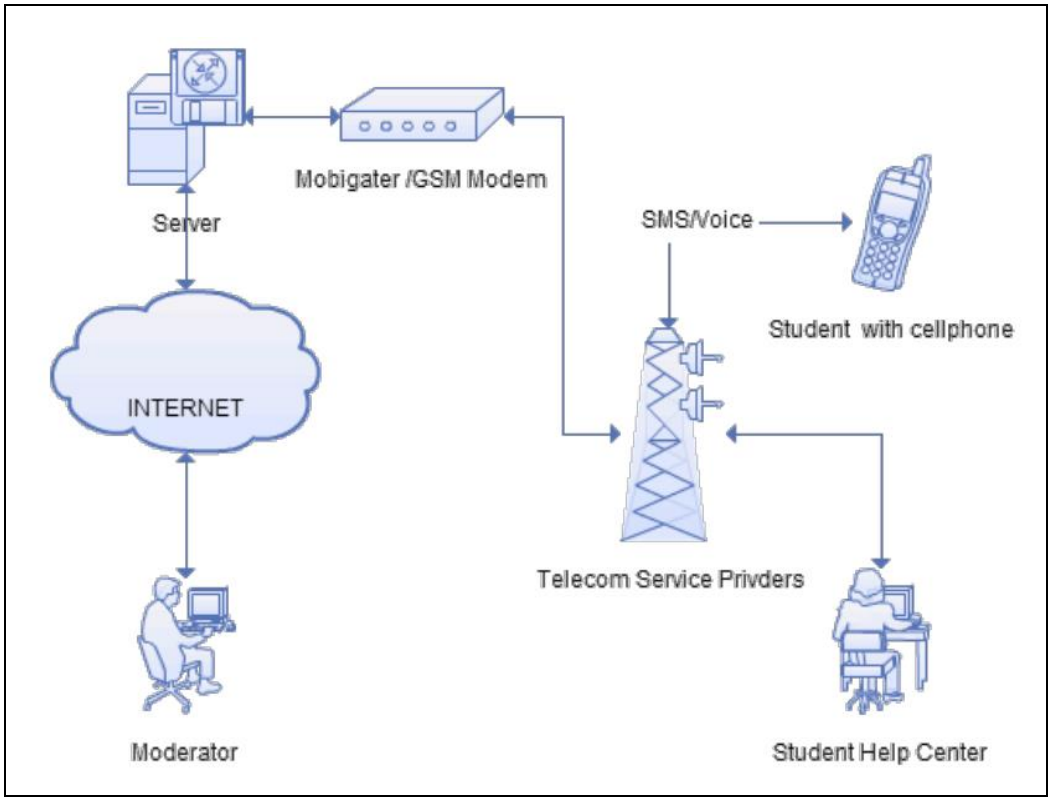

Figure 5: Components of a MoMath Prototype Adopted from Shao (2014)

Kato et al.(2021) explained the key components of designing DL. These are open access to information, the facility of access, uncomplicated interface design, high quality of the communication process, internet performance, performance assurance service, ease of communication through social network, and patron-driven acquisition. Further, DL should increase digitized content and assign metadata to it; increase server processing speed, bandwidth, and server port speed; and

promote the DL through social media (Jelena and Aleksandar, 2021). The components of DL are shown in figure 6 below.

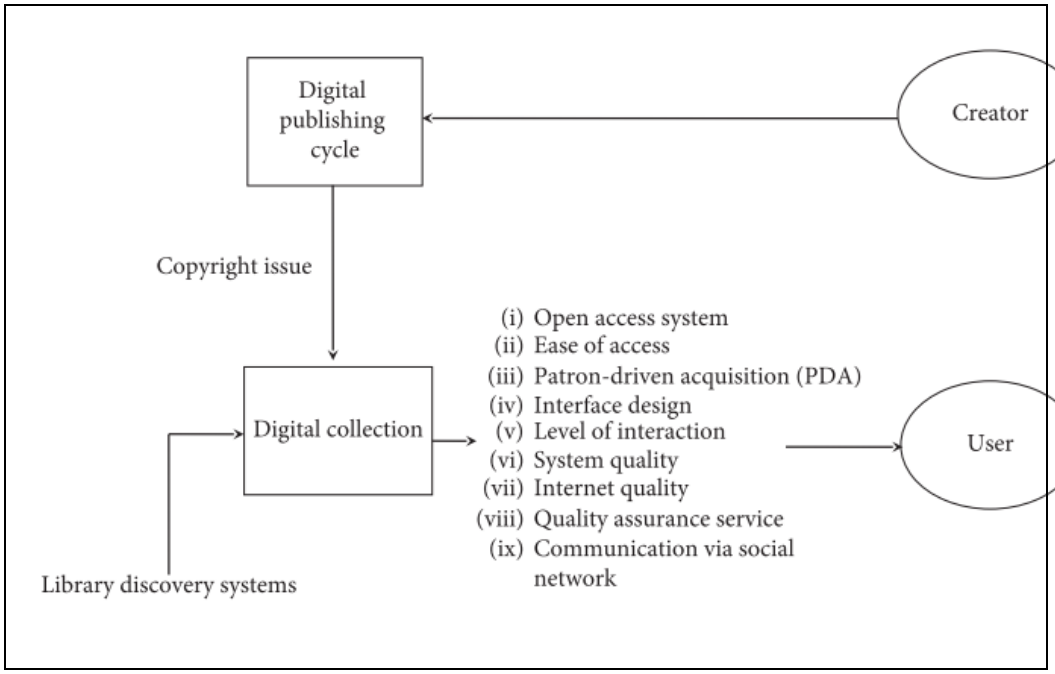

Figure 6: Proposed Digital Library Service from Kato et al. (2021)

Mageto (2021) proposed a prototype that would manage tasks that include appointments, lending, reserving, returning, processing payments, storage of book records, provide information and processing invoices for orders. There is need to consider the user experience when evaluating the DL to provide a useful insights of different aspects of the user interactions, interface, perceptions and affective variables (Barifah et al., 2020).

Discussion

The Software used by Tutors to Design Multimedia Contents for DL and LMS

The study found PowerPoint as the most frequently software used for designing multimedia contents. It appears from this that tutors' ability

to create multimedia content using other applications rather than PPT is restricted. The limited potential of ICT integration in TC as a result of tutors using PowerPoint in Tanzania was also reported by Machumu, Josephaty, Zhu, and Anania(2022). The lack of adequate multimedia abilities was also found to Tutors in TCs (Venance, 2020). Exemplary multimedia (digital) content that a tutor can create with a well-crafted narrative are shown in figures 7 below.

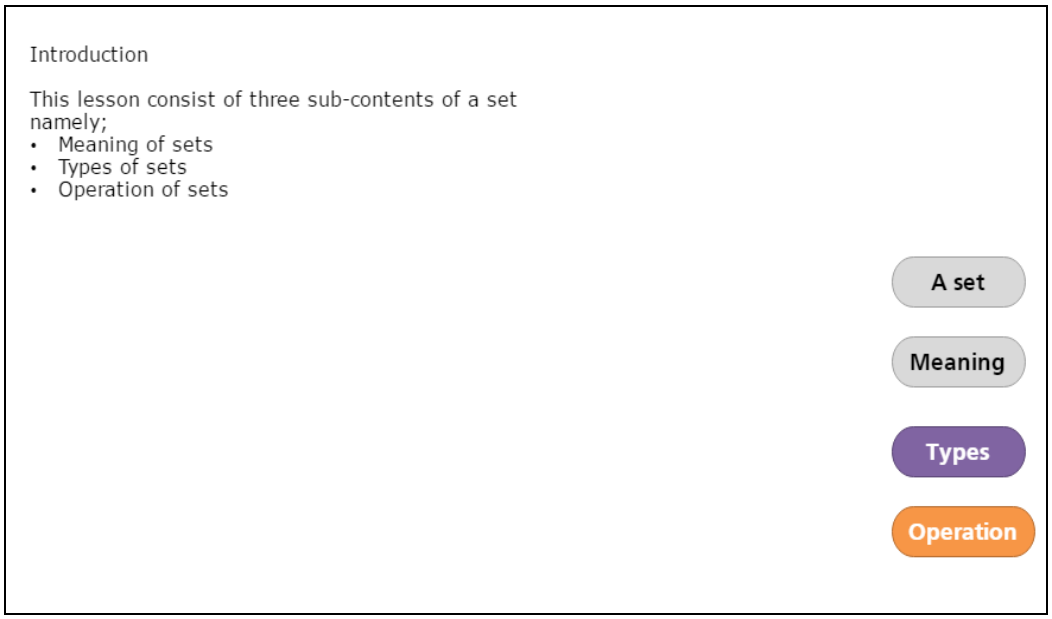

Figure 7: Multimedia (digital interactive) content for DL and LMS (A researcher own work)

After a learner click a button of type of a set; he or she will meet with different types of set. If the learner decides to study an empty set, he or she will click the button for an empty set. He or she will find the digital contents as shown in figure 8 below.

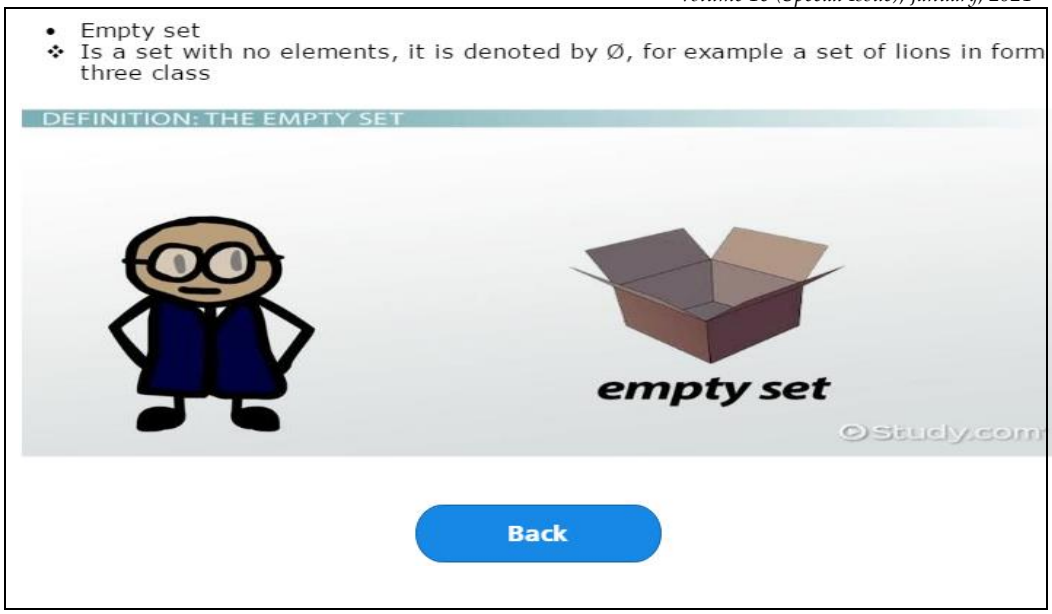

Figure 8: Multimedia (digital interactive) content for DL and LMS (A researcher own work)

The Status of Integrating LMS and DL in Tanzanian TCs

The study answered this question through questionnaire and interview of a principal and ICT tutor. Generally, TCs in Tanzania integrate ICT in term of LMS and DL at substitution and augmentation level. These are lower level of ICT integration compared to modification and redefinition (Puentedura, 2006; 2013; 2014).Similar results found by Jude et al. (2014) at Makerere university found that the integration of ICT is still at infancy stage. There is a need for the government and other stakeholders to shift from substitution and augmentation levels to modifications and redefinitions. The interviews revealed low levels of competencies of using LMS amongst TCs in Tanzania. The records indicate that only (20%) of TCs integrate LMS in teaching activities. In a similar vein, Winata, Fadelina, and Basuki (2021) validates the findings by showing that many librarians and users faced obstacles such as substandard internet networks and internet wastage when use DL and LMS. Similar non-significant results were found in the study of Okeji

and Adebara(2020) in which educators in the library schools identified challenges such as lack of qualified ICT staff to handle the course and lack of computer laboratories equipped with modern computers with stable internet facilities. The TCs and other stakeholders should ensure that the LMS operates efficiently because it plays a critical role in facilitating the e-learning process, exchanging learning resources, and streamlining learner assessment, as argued by 73.5% of participants in the Ngeze (2016) study. Also, in study done by Mhache (2017) found that, LMS like Moodle platform bridge the gap and provide access to education to all regardless of distance like during Covid-19. In addition, various studies examined on pre-service teachers' experiences on e-learning during the Covid-19. The study found that, experience on e-learning of pre-service teachers contribute in increasing their competence in applying ICT in their teaching (Pilli & Batur, 2023). Therefore, e-learning lead to student centered learning that increase innovation (Prosper & Mnyanyi, 2017).

The best Prototype for Developing Digital Library System (DiLaS)

The researcher proposed a prototype that integrate DL and LMS based on previous findings. A talented content expert will cooperate with digital content creator and multimedia expert to prepare the contents. The prepared contents will be sent to administrator ready for uploading in DiLaS. Students will learn contents; teachers will learn contents and methodologies for teaching and other educational stakeholders will provide feedback. The feedback provided will then be used as a tool for evaluation in learning. Finally, evaluation made will be used for further improvements in terms of subject contents and methodology of teaching. The summary of the DiLaS components have been summarized in figure 9 below.

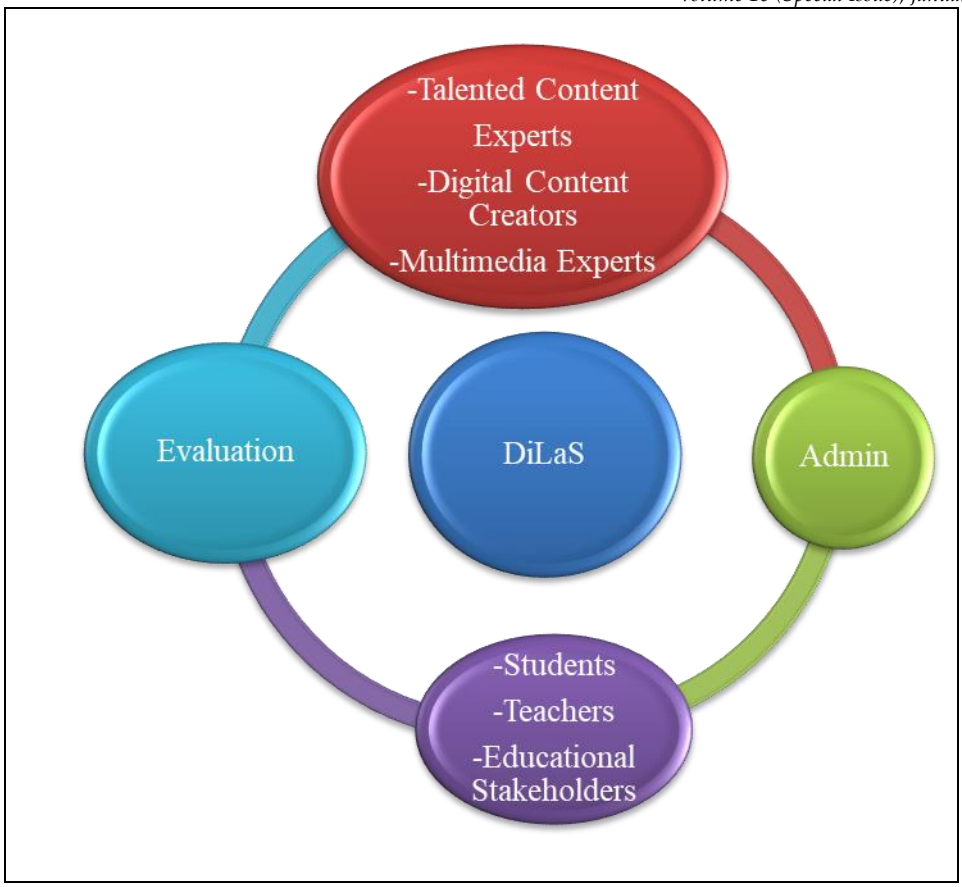

Figure 9: Proposed Prototype for Digital Library System (DiLaS) (A researcher's work)

Conclusion and Recommendations

This study aims to explore the integration of LMS and DL to preserve the talents and skills of teachers, experts, and students. The study adopted both descriptive and inferential statistics to obtain the findings. The study found that ICT skills possessed by majority of tutors toward their methodology used to integrate ICT in TCs are inadequate to integrate DL and LMS. The ICT skills of tutors in TCs are inadequate because they are at levels of substitution and augmentation based on the model adopted. The government should raise the level of ICT integration in TCs up to modification and redefinition levels by improving ICT infrastructure and reviewing the education policy and

ICT syllabus at least every three years. Furthermore, there is a need of recruiting tutors with relevant skills in ICT and frequent ICT trainings should be provided. The study recommends to the government that the National Examination Council of Tanzania (NECTA) must have a policy and strategies that support innovators to implement DL systems. The strategies will preserve exceptional skills innovated by talented educational stakeholders for students' learning and assessment.

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